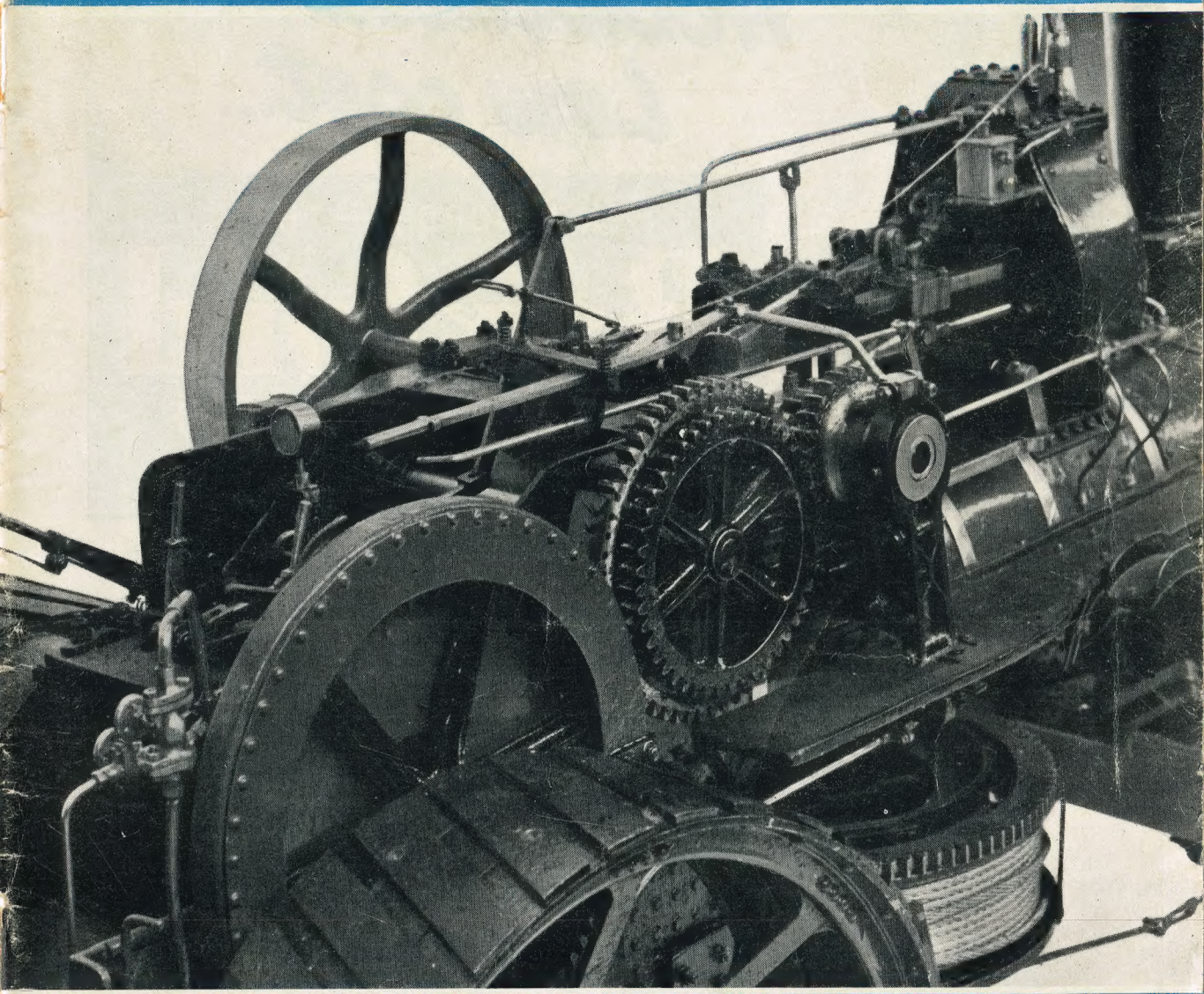
THE MODEL ENGINEER



IN THIS ISSUE

● MAKING A LATHE BORING HEAD ● TAPPING GUIDES FOR SMALL DIAMETERS ● THE NEW LOCO TRACK AT WORKINGTON ● BUILT-UP MILLING CUTTERS ● MORE HISTORICAL MODELS MAKING A SIMPLE BEAM ENGINE ● SUBSTITUTE MATERIALS

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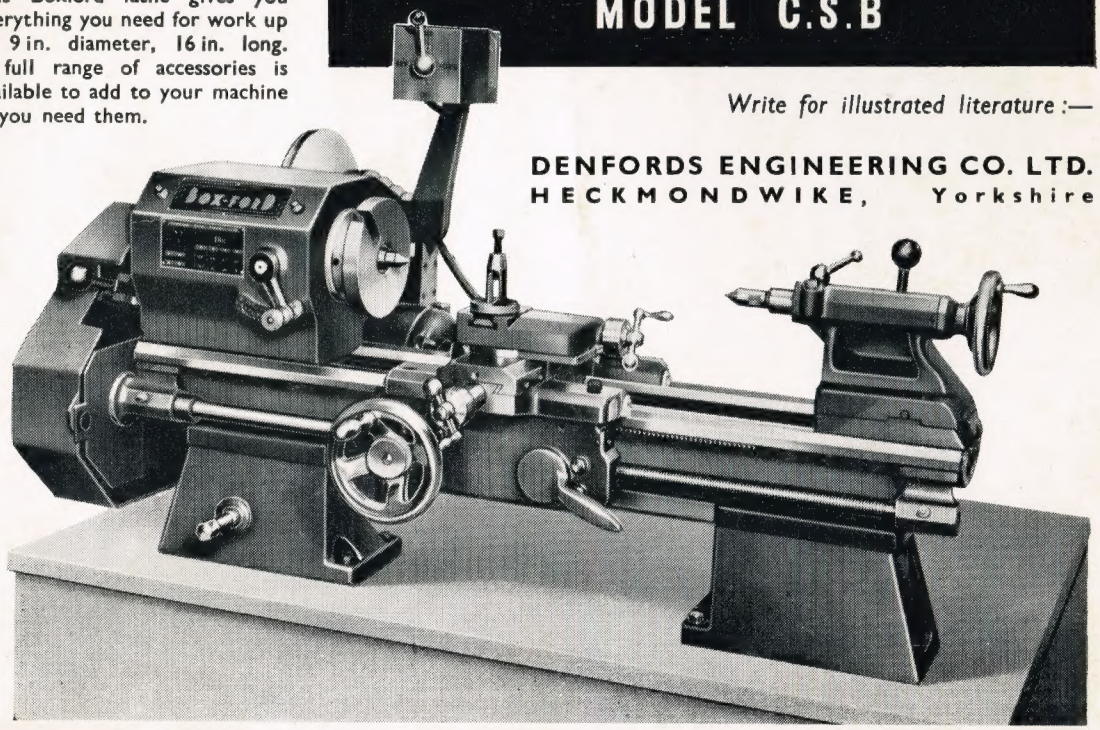

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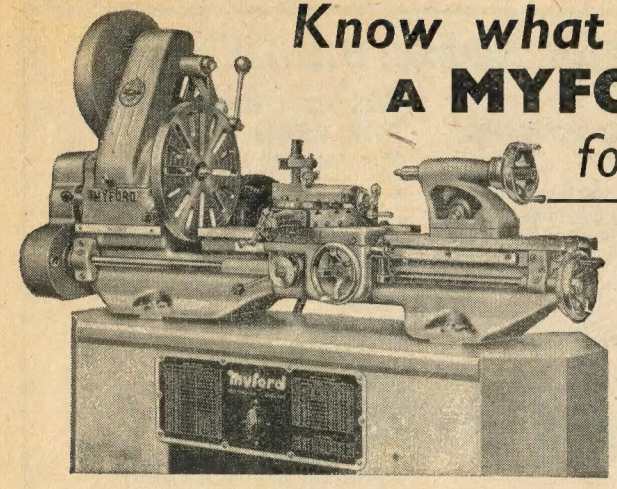

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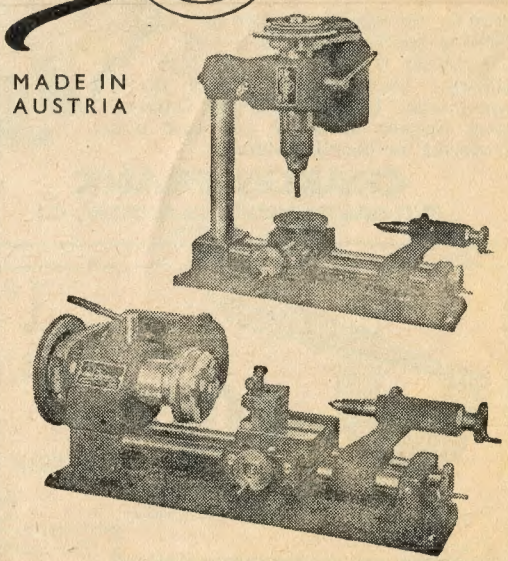

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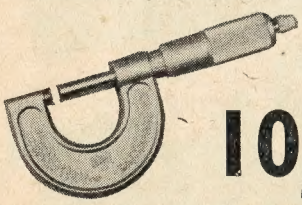

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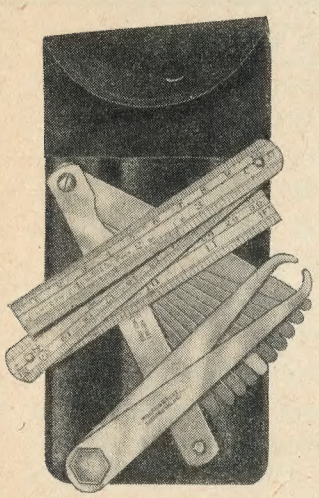

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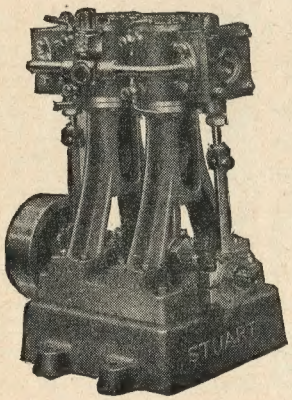

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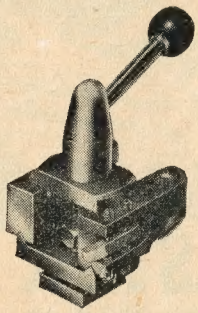

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THE
MODEL ENGINEER

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DECEMBER 30th · 1954

ESTABLISHED 1898

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OUR COVER PICTURE

The deceptive picture on our cover this week might well be taken for a view of the principal part of the machinery of a Fowler ploughing engine; there is little, if anything, in it to suggest that it is otherwise. However, the original photograph was taken at the "M.E." Exhibition last August, and is of one of a pair of 1-in. scale, non-working models of Fowler ploughing engines made by Mr. R. W. Palmer, of Southampton. The great accuracy of the visible details is very commendable and most striking.

SMOKE RINGS

The "M.E." Index

IN THIS issue, which marks the conclusion of the one hundred and eleventh volume of THE MODEL ENGINEER, we include the complete subject index of the volume, in conformity with our usual practice, which was interrupted only for a period during and after the war, due to the restrictions in the supply of paper.

Examination of this or any other "M.E." volume index will reveal the wide range and variety of subjects which have been dealt with, not only dealing with the construction of models, but also practical engineering design and practice in all its branches.

We make no claim to the status of an authority on general engineering, and we usually try to avoid encroaching on the province of other specialised journals, but many of our readers who are fortunate in possessing a collection of "M.E." volumes have found them a valuable reference library, helpful in many unusual and difficult engineering problems. During the fifty-seven years of its existence, THE MODEL ENGINEER has rendered useful assistance to both amateur and professional craftsmen, and we trust that it may long continue to do so.

Those Awkward Queries!

EACH WEEK the "M.E." Queries Service deals with a very large number of technical queries submitted by readers, only a very small proportion of which can be published, by reason of the demands on our space. The subjects dealt with embrace practically every field of engineering, from the design of relays for radio control circuits to the repair and maintenance of heavy industrial machinery, and there are few instances where we are unable to offer querists some helpful advice and assistance. At the same time it will be realised that it is impossible, within the scope of this service and the facilities for obtaining the most up-to-date technical information, to reply to every query in minute detail or to ensure that the fullest possible information is supplied. Highly specialised queries are often passed on to our technical consultants in the particular branches of engineering, but it sometimes happens that readers with experience in these matters are in a position to amplify the information given, or possibly to correct us on minor points. We gladly acknowledge the assistance thus rendered, which is characteristic of the helpful spirit which exists between members of the model engineering fraternity, and we never fail to publish any contribution to the solution of readers' problems, even when it apparently contradicts our own advice. So far from shaking the confidence of readers in our ability to aid them, however, we find that our efforts are generally appreciated, and we receive many grateful acknowledgments from querists to whom our advice has proved to be "just what the doctor ordered."

Apprentices on Show

VISITORS TO the Schoolboys' Own Exhibition, at the Royal Horticultural Hall, Westminster, are able to see British Railways trainee apprentices at work on engineering crafts and to operate the controls of a British Road Services lorry.

Twenty-four apprentices and eight instructors from the British Railways Works Training Schools at Derby and Wolverton (Bucks) are in London to enable visitors to the British Railways stand at the Exhibition, particularly schoolboys, parents and schoolmasters, to gain an insight into the training methods. The trainees are engaged in metal-working, painting, moulding, coach-trimming, electrical installing and other crafts required in the railway industry. Machine tools, a smith's hearth, moulder's crucible and work benches have been brought from the schools so that they may continue their courses of practical instruction.

The principal feature of the British Road Services stand is the cab of a 14-ton lorry, in which visitors are able to "drive" the vehicle, start the engine, change gear and operate the lights. Models and pictures of some of the huge vehicles which carry freight on Britain's roads are also displayed, and literature, maps and coloured reproductions of British Road Services vehicles are available to enquirers.

The New Track at Workington

Lt. Col. Hugh Simpson of Penrith, about to leave "Guild Hall" station with an attractive cargo! The loco. is Col. Simpson's famous North Western "Claughton" in 3½-in. gauge

SINCE the publication of a recent "Smoke Ring" referring to the track at Workington, Cumberland, we have received some interesting information from Mr. W. Tully, secretary of the Cumberland Guild of Model Engineers and Craftsmen. There are some rather unusual features in the design and construction of the track; they were briefly mentioned in the "Smoke Ring" referred to, but, in reply to our request for further details, Mr. Tully has kindly sent us the sketches, photographs and data included in these notes.

First, a few words about the guild; it began in January, 1952, as the West Cumberland Society of Model Engineers, which title was adopted by the 28 men who met at the County Technical College, Workington, at the request of Messrs. H. Bacon, of Seaton, L. Jones, of Maryport, and E. Sharratt, of Distington. After a somewhat hesitant beginning, the outlook and activities of the club were completely transformed in March, 1953, when the Electroflo Meters Co. Ltd., of Maryport, granted workshop facilities for the use of the club's members.

At the local Agricultural Show in Curwen Park, Workington, the previous year, the club had a 40-yard length of temporary track in operation; it was so popular that an approach was made to local industries for support in building a permanent track. A site was offered by the Distington Engineering Co. Ltd. at their Chapel Bank Works, but after some preliminary work had been done, it was found to be unsuitable. The Workington Borough Council offered the use of a very beautiful plot in the grounds of Workington Hall; and here the present track was built by teams of members during the winter of 1953-4. In January, 1954, the club's title was changed to the present one, at the suggestion of Mr. B. Dunglinson, president of the club and chairman of Electroflo Meters Co. Ltd.

The complete circuit is 830 ft., the rails being laid to accommodate 3½-in. and 5-in. gauges Right at the start, some 500 tons of rubble, etc., had to be moved, most of it by manual labour.

Details of Concrete Beams, etc.

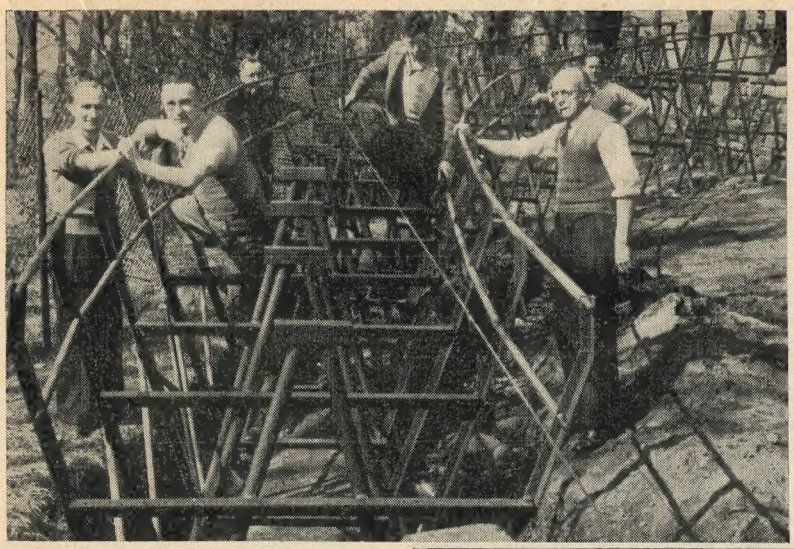
The rail is aluminium alloy, ½ in. × ⅜ in. rectangular section, held by mild-steel chairs screwed to 8-in. wood sleepers at 4 in. centres. These are supported on 6-ft. × 8-in. × 4-in. concrete beams laid on 14 in. high pedestals, each 6 ft. beam is reinforced by a 6-ft. bedside angle.

A layer of cement (mixed with granite dust) was grouted to the top of each beam and cambered where necessary.

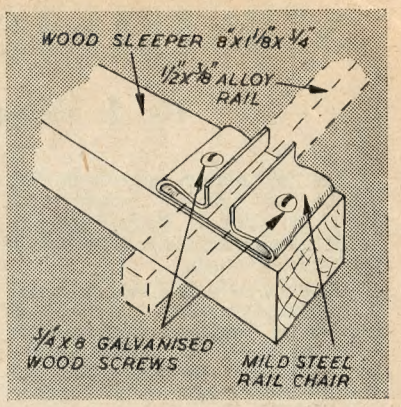
The track was laid in 10-ft. sections; each section being secured to the concrete beams by steel wood screws in lead plugs. Instead of fishplates at the rail butts, the ends of the rails of each 10-ft. section are slotted in solid aluminium sleepers.

The largest single job connected with the actual track itself was the manufacture of the 7,500 plus mild-steel rail

A section of the model display, September 25th, 1954. Treasurer R. Gate snatches a sandwich while making sure his boiler (Calor gas fired) is providing plenty of steam to keep the working model section in action



A group of members pause for a while during the initial stages of bridge construction—Easter weekend, 1954



Mild-steel rail chair used on the Workington track. The inside vertical flange of each chair is shorter than the outer flange

Right: The 63 ft. steel trestle bridge from the south end, complete except for end sections of hand rails

chairs. These were pressed out of $\frac{1}{16}$-in. mild-steel 1-in. strip, using jigs designed and constructed by member L. Jones. The manufacture of these chairs occupied many Guild Practical Nights at the factory, requiring three operations on the press, followed by drilling two holes, degreasing, parkerising, stoving with black bitumous paint and finally screwed to the sleepers, with 15,000 screws ! The sketch shows the method of attaching the chairs to the sleepers.

Steel Trestle Bridge

The 63-ft. steel trestle bridge was designed and constructed in its entirety by members. After the initial task of designing and stressing the structure, teams of members then prepared the site—laid concrete foundation blocks—and on the Guild's Practical Evenings, facilities of which are made possible at the Electroflo Meters factory, Maryport by the President, Mr. B. Dunglinson, work was then started on the manufacture of 21 steel trestles required for this bridge. Material required for each trestle was in the region of 14 ft. of $1\frac{1}{2}$ in. diameter steel tube, 16 ft. of $1\frac{1}{2}$ in. $\times$ $1\frac{1}{2}$ in. $\times$ $\frac{1}{4}$ in. angle-iron. General method of manufacture was templet drilling, to ensure all holes were in alignment for the hand rails. Cross angles were drilled for the catwalk boarding; the whole frame is a welded section prefabricated at the factory and finally assembled on the prepared foundations. In addition, the bridge heads were built in position (and 220 ft. of $\frac{3}{4}$ in. galvanised handrail was cut to suit) and reinforced by concrete and stone work.

(*Continued on next page*)

Great activity around the steaming bays, getting ready for the Grand Parade—September 25th, 1954

SUBSTITUTE MATERIALS

By J. Dewar McLintock

ANYONE who has much to do with modern full-scale industry will know that there is increasingly wide use of materials which are in no sense of the word, traditional.

The writer has himself used hardboard for platform-type model car chassis, as well as for workshop improvements, home decoration, etc., whilst it makes a good temporary baseboard for little jobs like making patterns in Plasticene, for glass-fibre modelling, etc. If finished in primer and hard gloss paint, the material appears to be completely weatherproof, and its "end grain" remains smooth on cutting, filing or planing.

There is a material in somewhat the same class, known as Formica—this being a particularly hard form of rigid plastic. It is relatively expensive, and is proof against almost everything—except cutting, drilling, etc., of course ! Available in many very pleasing finishes, it should interest makers of non-engineering models—e.g., architectural and scenic types.

In the plywood field, which still has so many staunch adherents, the advent of oak-faced and metal-armoured plywoods should be kept in mind. Resin-bonded waterproof plywood, too, is something comparatively new and valuable.

Plastics

One could write a whole book on plastics—indeed, some folk have done so—but for general purposes the model maker should know that acetate, polyvinyl chloride and acrylic sheet are his "best bets," and he will find those descriptions will be familiar to retailers of plastics—of whom, more's the pity, there are but few.

Acetate, p.v.c. and acrylic sheet (Perspex, if you prefer it) all react in different ways to heat. Acetate is particularly amenable to gentle work with a bunsen burner, and can then be moulded into double-curvature shapes, preferably over hardwood patterns. Perspex is hard and glasslike, and it is customary to use metal-working tools on it. Contrary to popular supposition, scratches can be removed from it with certain mild abrasives, but acetate is not so easily restored to brilliance.

Condensed-milk Plastics

Casein plastics—sometimes rudely (but not altogether unjustifiably) referred to as condensed-milk plastics—are very soft and easily melted, but quite hard and rigid when set. Try the effect of heat on "Junior's" discarded plastic toys, but do it in a safe place, just in case. . . . Incidentally, Bakelite Ltd. have many informative leaflets, and they produce a particularly interesting crystal-clear sheet which can be bent double, like cloth, without suffering.

Rubber Materials

There are a number of interesting new materials made from, or allied with, rubber. Latex foam (in one form known as Dunlopillo) can be useful in many applications, and can be cut with household scissors. Latex, and artificial latex (made with pulverised rubber dispersed in water and/or oil) are the bases of many very powerful adhesives, of which Bostik and Dunlop D.S.P. are the best known. In many cases these will "stick anything to anything" and in case anyone should feel that such aids are *infra dig*, it must be emphasised that motor, commercial and railway coach builders use them consistently and with excellent results. Rubber solution is still used, but the latex types are more powerful.

There are also many modern resin-based adhesives, some of which are powerful enough to bond metal to metal.

Many model engineers will be familiar with Rexine, which is the trade name for I.C.I.'s cellulose-coated cloth which has been so popular for very many years. There are now a number of somewhat similar, but plastic-based, materials, however, such as Vynide. These not only simulate leather more accurately, but are often easier to work, and for small-scale work will sometimes conform to shape more closely without puckering.

Some of the modern metal foils and metallic papers are not to be sneezed at for non-engineering and scenic models, nor for certain aspects of model boat work. Details of many of these are obtainable from the trade papers dealing with printing and packaging.

And finally . . . glass-fibre. The writer need not go into detail, for others are doing this currently, but he would hasten to add that the stuff is great fun to work with, and has great possibilities, particularly as every man is his own expert, so far !

THE NEW TRACK AT WORKINGTON

(*Continued from previous page*)

Handrails were fitted to trestles during the construction of the bridge, and a complete assembly of the bridge was well under way. All the trestles were braced with ⅜-in. galvanised tubes and crossbraced to each vertical stay; another 350 ft. of ⅜-in. galvanised tube was bolted to suit.

The gantry on each side was laid with 1,000 ft. of hardwood (cut from old packing-cases) the hardwood slats were fixed on 2 in. × 2 in. bearers and the structure was completed by the double track running on wooden bolsters.

From the initial design to the completion, including two coats of black Apexia paint, two undercoats and one coat of green gloss paint provided gratis by Messrs. Goodlass Wall & Co. Ltd., Liverpool, the entire work was carried out with exacting craftsmanship —in less than 12 months.

The average height of the bridge above ground level is 6 ft. 4 in.; the greatest height is 9 ft. 6 in. The width of bridge is 4 ft. 6 in. and the radius of curvature is 66 ft.

12 ft. Alloy Turntable Section

This project was designed and constructed by our chairman, Mr. E. Sharratt; it is constructed entirely from aluminium alloy parts given by Messrs. High Duty Alloy Ltd., Distington.

The turntable consists of two 4 in. × 3 in. channel-section girders secured to a rectangular plate on the top of a vertical 12 in. length of 8 in. diameter tube. The 12 ft. members are bolted together by eight 2 in. × 2 in. angles underneath, plus the 25 channel-section 8 in. sleepers on top.

The turntable pivots on an alloy pillar and can be hydraulically lifted a maximum of 6 in. by a hand-operated oil pump and connects with two 12 ft. steaming bays and the 90 ft. siding used for storing our ten eight-wheeled passenger cars.

The turntable is located in position by stainless steel cones and sockets made by member L. Jones.

Generous gifts of materials of all kinds were made by local firms and friends of the guild ; otherwise the work of construction would have taken far longer and at much greater cost. The next major project is the erection of a clubhouse and workshops on a site reserved for it close to the turntable. The guild caters not only for all kinds of model engineering interest, but for any of the allied crafts; we feel sure that much more will be heard about it in the future.

L.B.S.C.'s Lobby Chat

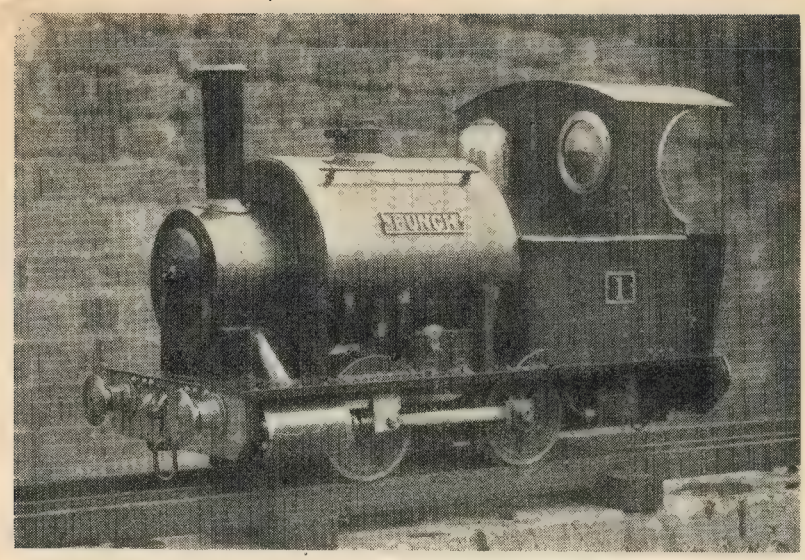
• A "MINX" GOES GREAT WESTERN

A QUESTION frequently put by correspondents who are new readers and who want to build a copy of some special pet type of locomotive, is whether any of my "guaranteed" specifications could be adapted to it. Now, as a matter of fact, although some folk are diffident about making the admission, there are many so-called "freelance" locomotives which are just made up from a combination of the components described in these notes. There are also plenty of other locomotive builders who build the working parts of an engine described in these notes, and doll her up in some other costume, making what small variations are necessary, to suit whatever class of full-sized locomotive she represents; and they are only too glad to acknowledge the basis of the job. For example, Mr. L. J. Markwick built my 5-in. gauge *Minx* as a tank engine, calling her *Manx* because she then had no tail; and a jolly fine job she turned out, as all unprejudiced persons who have seen her working on the Beech Hurst line, will gladly confirm. Then we have the engine recently illustrated, when under construction; to wit, Mr. G. Cashmore's *George the Fifth*, with the "works" of the *Maid of Kent*. There are many others; the latest to come to my notice is the very fine Great Western pannier tank engine illustrated, which, like the one mentioned above, is based on the *Minx*. She was built by Mr. L. B. Parkin, of West Drayton, and is an excellent piece of work, both in appearance and performance.

Instead of the single pump specified for *Minx*, friend Parkin (in view of the way his locomotives perform, "Bro. No-Parkin" would be a suitable nickname ! !) fitted twin pumps of a total capacity equal to the single one, but says that they could have been made much smaller, and still supplied the needs of the boiler. There are two tool boxes on the running-board, and the mechanical lubricator is hidden in one of them; the other contains a Veeder cyclometer. The star wheel of this is driven by a ratchet arrangement; and to get the actual miles that the engine has run on a trip, the last figures are read as units instead of tenths, and the whole reading divided by 6. In addition to the pumps, an injector is fitted, made to my specification, and this works all right, even when the water in the pannier tanks warms up to 90 deg. The boiler is similar to *Minx*, but the firebars are tack-welded to the ashpan, to make them a single unit.

Our worthy friend says that the maximum drawbar pull so far recorded is 63 lb., taken when the train was moving at about one mile per hour, after opening the regulator very steadily, to prevent the engine "losing her feet" when starting the heavy load. She will slip slightly under an acceleration test with a light load, and gets away to such good purpose that the driver gets an actual push in the back. She has preformed on the Beech Hurst line, and when climbing the so-called heavy grade with three carloads of passengers, the blast was inaudible at 30 ft. distance, so there was no complaints of choked tubes spoiling the run. Probably friends and relations of Inspector Meticulous will find fault with the shape and size of the chimney and dome, and other minor details; but as she does the job that all locomotives are expressly intended to do (that was unintentional !), I don't see anything to worry about.

A Great Western cousin to "Minx," built by Mr. L. B. Parkin



Mr. Parkin's Swansea and Mumbles "Pug"

The little "pug" was built by friend Parkin about six years ago, and was the first locomotive to perform regularly on the Harlington club track. She did most of the passenger-hauling for the first two seasons, and has required no overhauling. She can still romp over the track all day, pulling two carloads of kiddies, on about a pocketful of coal. She has Stephenson link motion, eccentric-driven pump, and your humble servant's type of mechanical lubricator. A hand pump is fitted in the cab, the back of which is removable for driving. She is copied from an engine built by the Vulcan Foundry Co. for the old Swansea and Mumbles Railway.

Mention was made in the exhibition reports about the 5-in. gauge *Lion* which was built by friend Parkin. He sent me two good photographs of her, reproduced here, and says she was built to my instructions for the *Titfield Thunderbolt*, and details are slightly different, as she was finished ahead of instructions to get her in the exhibition. He called her *Lion* because the nameplate was easier to make ! She, too, is a fine worker; in fact, with 80 lb. pressure, she was a bit *too* good for a representative old-timer, so he lowered the working pressure to 50 lb., same as the full-sized engine, and with that, she performs "to the life." Hearty congratulations to Mr. Parkin on his excellent work, also to Messrs. D. Ball and J. Holding for their fine clear photographs.

Another Friend Passes on

Anno Domini is robbing me of my few old friends; the latest to fall to the scythe of the Great Reaper is "Bro. Smiler," who passed to the Land Beyond the Veil just recently. It is over thirty years ago since I first met H. C. Sturla, who was a foundryman by trade, and ran a small brass-foundry business at Waltham Cross; when my notes first appeared in this journal, he wrote me at my old home at Norbury about the composition of a suitable non-ferrous alloy suitable for "redhot" steam. There was nothing "technical" about his friendly letter, but it was apparent that he really knew what he was writing about. He told me that he was a locomotive-builder, and I invited him to come over, which he did. He told me in the letter that he was known as "Smiler," and as soon as I met him, I knew why; a more cheery soul it would have been hard to find. That day a friendship was started, which endured without a break, right up to the time of his passing.

"Bro. Smiler" was a master of his craft; he once told me that there were over 600 recognised varieties of non-ferrous metals used in foundry work, and I honestly believe that he knew every one of them by heart, and could have mixed the alloys from memory. He cast the cylinders for some of my engines, from my own patterns, and gave me cast sticks for various purposes from time to time; I still have quite a good supply. He was a real friend to many builders of small locomotives, whose pockets were shallow; like myself, he didn't agree with the idea frequently expressed that those who follow a hobby should expect to pay for it. Many of my correspondents of days gone by, were enthusiastic enough, but often had not the wherewithal to satisfy their requirements; so, if one such wrote me that he could not afford "catalogue price" for, say, a set of cylinder castings, I used to put him in touch with Sturla, who would supply him with the needful, off my patterns, at "price per lb." which was considerably less than quoted in catalogues. He also supplied castings off the customer's own patterns, where available, at the same rate. In certain quarters, which I needn't mention here, this was frowned on, as being akin to undercutting the advertisers of that time, but I didn't agree with that, either. The advertisers lost no business, because they wouldn't sell their castings unless they received payment; and if the hard-up enthusiast couldn't afford their price, they wouldn't have received the order, anyway. By supplying at a price they *could* afford, Sturla did them a good turn, and harmed nobody.

He also supplied "the trade" in those days before the era of the live passenger-hauler. Practically all of the castings used and sold by Stevens' Model Dockyard came from the little foundry at Waltham Cross, and he also supplied some to Whitney's of City Road. Many an amusing story he related to me of the old firms. For example, the Aldgate firm, which was Stevens, wouldn't have anything but soft brass for the various components they sold finished; the reason was, that all the machining was done on small treadle-driven lathes. If they had had power-driven machinery, they would have come under the Factories Act, and been obliged to comply with certain regulations; also, there would have been a considerable insurance premium to pay. The use of treadle lathes, hand drills, and the usual simple hand tools, cut that all out; and to give Stevens their due, they didn't do badly at all, for the period. I still have a small drawerful of their fittings: plug cocks, unions, oil cups, whistles, water-gauge —"high-class fitting, exquisitely finished, in best machinery brass, with three taps" (*sic*) safety-valves, angle-valves, and what-have-you. Sturla gave them to me after the passing of the last of the Stevens brothers, when the old stock was disposed of. I also had one of their locomotives, but gave it away to a young friend, many years ago.

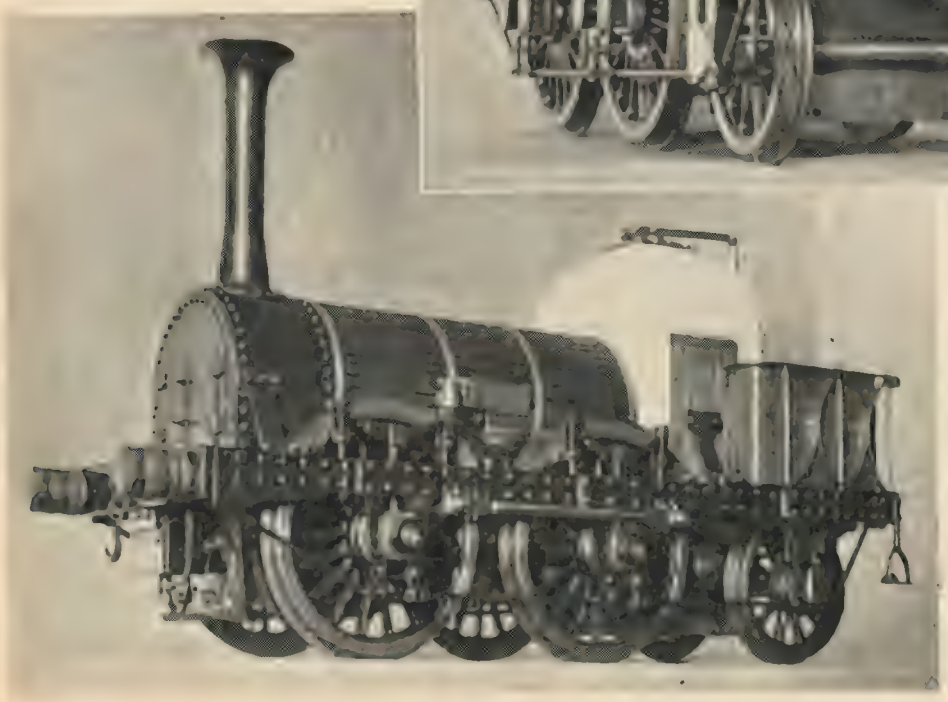
In later years, Sturla developed heart trouble, which was galling indeed to a man of his energy. He fought it for all he was worth; but one day, when driving his Morris Eight along Piccadilly, he "felt himself going," but was able to pull into the kerb and stop before he collapsed. Fortunately he soon recovered, and was able to drive home; but that was the "danger signal." Eventually he sold his little business, which was then turned into a company, under the same name; maybe some of our readers in the engineering line have done business with H. C. Sturla Ltd. of Waltham Cross. For some time, he kind of "kept his eye on the job" by frequent visits to the foundry under its new ownership; and his advice, from years of experience, was assessed at its true value. But the years were rolling on, and so he left his old home at Cheshunt to seek sanctuary in the "old folks' corner" of the quiet little town of Corringham, Essex, with his

good lady (who also suffered from bad health) and his parrot, which was more voluble even than that owned by the late Mr. H. G. M. Conybeare, well known to our older readers. It had the knack of saying the right thing at the right time; I, for one, don't believe that a parrot doesn't know what it is talking about. If you gave it a biscuit, it would gravely say, "Thank you," just like a human being; would greet visitors by name; call the dog and cat; and, once, when Sturla and his wife had been to visit their married daughter, they were late home. When Sturla switched on the light, he was greeted with: "So you've got home at last!"

After his retirement, Sturla visited me occasionally, in company with a friend, Mr. A. C. Barltrop, who runs an engineering business in North London, and is a builder of little locomotives. He would drive from Corringham to his friend's place, and then Mr. Barltrop would bring him along to our hacienda on his own car, to avoid Sturla driving through traffic. Occasionally, I piloted my own gas buggy to Corringham, which was some drive from my home, as I had to cross the whole length of South-East London, thread the Blackwall Tunnel, and dodge the traffic right through the East End; but driving through traffic never worried me yet! My last trip was about three weeks before the end; and although "old Smiler" was still his cheery self, something told me I shouldn't see him on this earth again. It was the same when I bid my last goodbye to Ed. Meers of Sturry, who ran the East Kent Engineering Co. Therefore, I was not surprised, though very sad at heart, when I received a note from his son to say that his father had passed on, only a few hours after visiting him. It was the son's wish that I should pass on the news to any folk who knew Sturla as a friend, hence this reminiscence; our old readers who knew him, and whom he maybe helped in time of need, will share my regrets and sorrow at his passing.

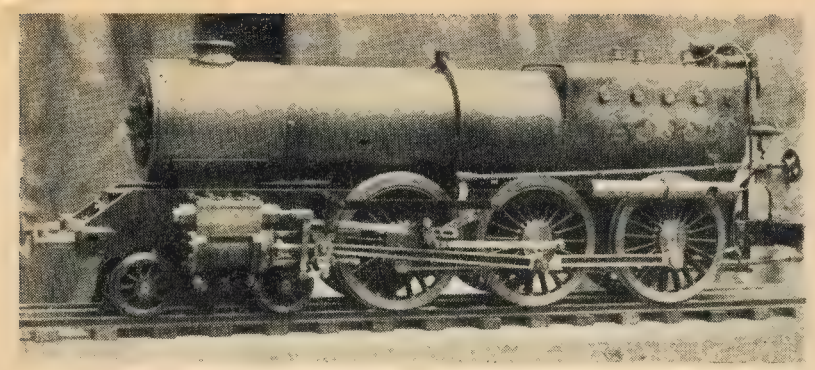
Distance No Object!

Apart from the fact that she is an excellent bit of work for a first shot, built under difficulties regarding time available, material and equipment, the unfinished *Olympiade* type locomotive shown in the accompanying illustration is of special interest, inasmuch as she is being built in Valparaiso, Chile. Correspondents overseas often say that these notes are followed "from China to Peru," and apparently such is the case! Anyway, the builder, Mr. Allan Reid, says that she has "astonished the natives," so far, as they didn't imagine such things were possible; and when he gets his line laid, and they see her on passenger-hauling, they will be more astounded still. Our far-distant friend has made a few variations from the original design, leaving out the middle cylinder, and fitting a parallel boiler barrel, to make the job easier and quicker; but that is no detriment.



A 5-in. gauge version of the "Titfield Thunderbolt" built by Mr. L. B. Parkin. Being finished ahead of instructions, she differs slightly in minor details

Mr. Parkin has certainly "captured the atmosphere" on this fine job; unlike many "museum pieces," she is a powerful and efficient worker



Mr. A. Reid's Chilean "Olympiade"

There are also two 3½-in. gauge engines of your humble servant's design, in Valparaiso, built by a young engineering student, Mr. Alvaro Orrego, who writes to me occasionally; one of them, a *Juliet*, was illustrated in these notes some time ago.

It COULD Happen

Having read with interest the various comments on Mr. W. B. Hockings's design for a super-locomotive of the future, it appears to me that the majority of them were of the kind that would be put forward by the Most Worshipful Order of Aginits ! Having made my own comments when offering the drawing, and writing the description, I don't propose to add to them here. Friend Hockings is quite able to deal with all points raised; but I would just like to remind certain adverse critics that they are basing their criticism purely on assumption. For example, it was stated that the engine could not be built within the existing loading gauge. The detail drawings of the cylinders, which I have seen, show that it could. Neither is there anything wrong with the design of the leading bogie; as a matter of fact, I prefer it to the Great Western *King* class bogie. The only valid objection to the design, under present conditions, is the weight, which is too much for the permanent way in this country, although the engine would not be too heavy for American roads laid with 150-lb. rails. I guess the "aginits" will be very much surprised to hear that certain high officials in the locomotive world not only think the locomotive is a practical proposition, but have examined it with a view to finding out whether it could be modified in certain respects, to cut down the weight sufficiently to allow it to run on British main lines, without alteration to the general design, and the special features, which are incorporated in it.

All Are Possible

Going back to the engines described in my "tales of the future," I took care to be quite certain that all of them were practical propositions before I introduced them into the said tales. If the new standard 109-lb. flat-bottom rails now being laid on British Railways main lines would carry an axle-load of 30 tons, then any of them could be built without modification of any kind. The three-cylinder 4-6-2 *Lady Vera* might need extra platform clearance, on account of her 23 in. outside cylinders; but the four-cylinder 4-6-4 *Queen Mabel* would be quite all right, as she is no wider than a *Britannia*, neither is the length excessive. The 4-8-2 *Cardean* would also clear, with her 22 in. outside cylinders, as she would be the same width as one of the old L.B. & S.C.R. Baltic tanks; and with a trailing pony truck of the *Britannia* type, she would be more flexible on the road, than the Gresley P type 2-8-2 class, which were converted to 4-6-2 by Sir Nigel's successor, Mr. Thompson. The 4-6-4 "simple-compound" L.N.W.R. *Jeanie Deans*, explained by her driver to Al and George in the first tale, is slightly smaller than either of the two last-mentioned, so no objections could be raised in her case.

Why Not Floating Heads ?

Regarding the valve-gears, it is a source of wonder to your humble servant that the piston-valve with separately-actuated heads has not been tried long ere this. Piston-valves with loose floating heads were tried on the Jones tank engines of the Metropolitan Railway which ran on the Aylesbury section, but they were not positively driven, and merely remained close together in the middle part of the steam-chest, just clear of the ports, thus affording communication between both ends of the cylinders, when running with steam off. When steam was on, the pressure in the steam-chest between the heads, kept them in position against stops on the spindle, and the valves then functioned in the usual way. One idea of poppet-valves is to give a separate and controlled release, but the trouble is the terrific concussion, and consequent leakage. My suggested arrangement does away with the curse of back-pressure; once you get rid of that, efficiency—as well as speed—goes up like a rocket. Mr. Churchward himself said that the trouble was to get the steam OUT of the cylinders; my valve-gears and setting do just that on little engines—nuff sed !

For the BOOKSHELF

British Railway History, by C. Hamilton Ellis. (London: George Allen & Unwin). 443 pages, 6 in. by 9¼ in. Illustrations on art-paper inserts. Coloured frontispiece. Introduction by Canon Roger Lloyd. Price 30s. net.

Although there is no statement to the effect, this book is clearly the first of a number, since it confines itself to the period 1830-1876. There have been railway histories written and published previously; but, as Canon Lloyd points out, they have been either worthless, when endeavouring to provide a comprehensive record of the railways, or classics of their kind, when devoted to one railway. The present book is a brave attempt to provide a general history of British railways, enough to ensure that the volume shall be, at once, comprehensive in its scope and useful as a book of reference. Obviously, a very great deal of research has gone into the compilation of the text, and the problem of selection must have been a difficult one to solve. It may be that all the text does not tell very much that is new; on the other hand, there is a considerable quantity of it that does, and in any event, to have it all between the covers of one volume makes the task of writing it worth the time spent on it. There are one or two slips of the pen, the worst being on page 270, where the reference to "the very famous eight-foot single bogie engines built by Patrick Stirling for the Great Western Railway from 1870 to the 'nineties" obviously requires some modification !

The illustrations are mostly of great interest and nicely reproduced. The coloured frontispiece from one of Ellis's own oil-paintings depicts a London & South Western Railway train at Guildford in the 1870s, and bears the stamp of authenticity, while it suffers rather less than usual from Ellis idiosynchrases. The other illustrations, thirty-nine of them, are half-tone reproductions of early paintings, drawings and photographs, some of them very familiar, others much less so, while a few are new and of great interest; but all are worthy of a place in a book of this nature. The dust cover is attractive and commendable in its delightful simplicity, especially in view of the kind of thing that some artists might have been tempted to provide for such a book as this ! The book may have its limitations, but it is unique of its type and it should have no difficulty in establishing itself as a standard work.

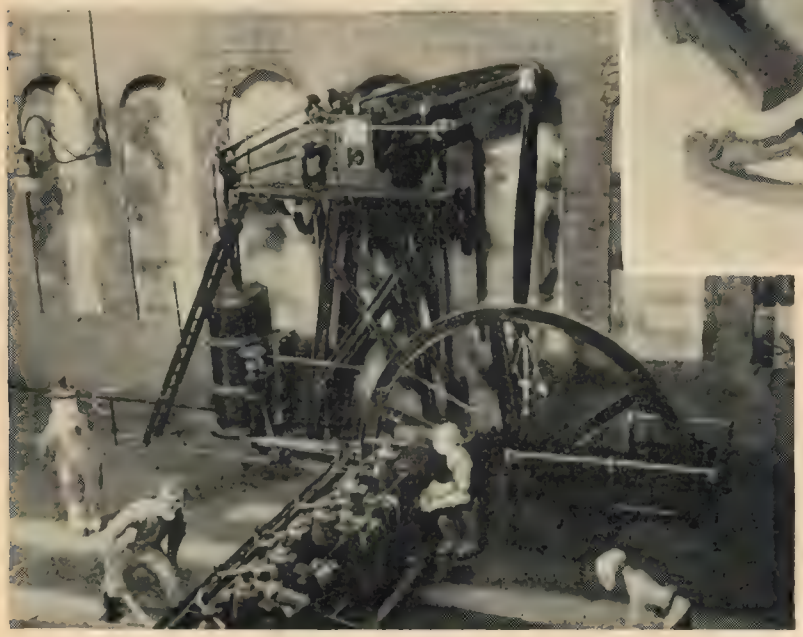
Historical Models

SOME EXCELLENT EXAMPLES DESCRIBED BY "HALLAM"

IN the rolling-mill of 1852, the item of most interest is probably the beam-engine. While this is a free-lance design, it is based largely on an engine exhibited by the well-known firm of Tuxford's at the Great Exhibition of 1851. It is, of course, a dummy, being

Continued from page 743, December 23, 1954.

Right: Some patterns for the beam-engine; crank, with chucking spigot, crankshaft bearing, beam bearing, parallel motion bracket, stirrup for pump-rods, and parallel motion lever



Left: Beam-engine based on Tuxford design of 1851, fitted with Watt's "first" paralell motion

driven by an electric motor, which carries a rubber friction-roller in contact with the rim of the flywheel under the baseboard.

As will be seen, the design is simple, the table carrying the main bearings being bolted to the tops of two cast A-frames. Most of the castings are in gunmetal, except those where the surface was not to be painted; e.g., the cylinder cover and valve-chest cover—where cast-iron was used.

The parallel motion is very much simpler than that fitted to most beam engines, but it is equally efficient, and quite fascinating to watch in motion. It is based on James Watt's "first" parallel motion, as actually used by Tuxford's. The dummy governor is driven by 2 to 1 bevel wheels from the crankshaft, on which an eccentric drives the valve-lever through the typical gab-gear of the period.

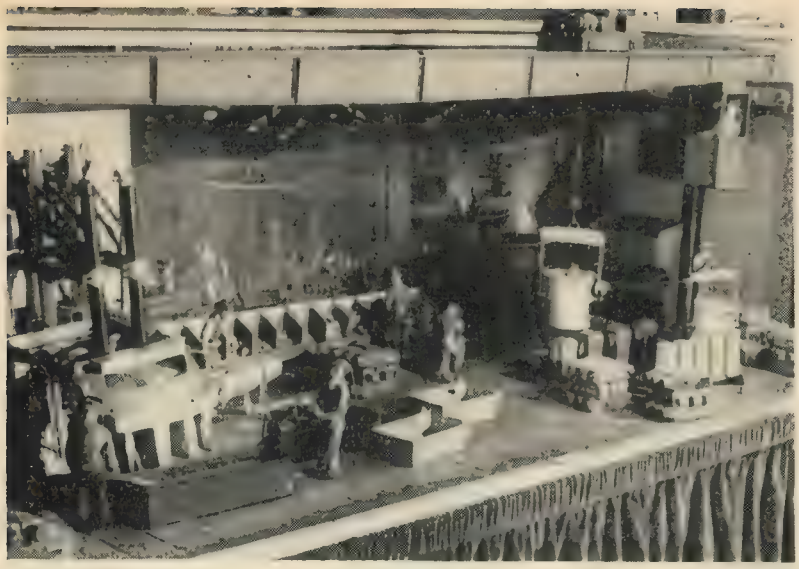
The over-head platform and ladder are not attached to the engine, but are supported by two brackets from the wall of the house. You will note also the multiple-burner gas-brackets on the same wall, a typical addition to the realism, and the country view seen through the windows, though in the photographs this is somewhat spoiled by the shadows cast by the photo-flood bulbs.

This model also was built by Mardett Models, drawings for the beam engine being prepared by Mr. Hughes.

Crucible Melting Shop

Another "Mardett" model was the bay representing the old-time crucible melting-shop, with acknowledgments to

Left: Crucible melting shop; foreground, melter pouring steel into ingot mould; furnaces in floor near back wall; crucibles drying on wall



A modern melting-shop, with 6-ton Heroult electric arc furnace. Storage bins in background contain manganese, cobalt, and other ingredients for high grade steels

Messrs. Benjamin Huntsman Ltd., of Sheffield, for assistance in obtaining authenticity.

The process illustrated is, of course, that invented by Huntsman, later improved by Mushet, and it is interesting to note that it has not yet been entirely superseded. The furnaces, fired by coke with natural draught, are in the floor—the trap-doors of some being seen open—with two "pots" being heated in each furnace-hole. When the metal was properly molten, the pot was lifted out. After removal of the slag floating on top, the metal was poured, as seen in the foreground, into the ingot mould. During pouring, the duty of the "second hand" was to collect remnants of slag on his iron rod.

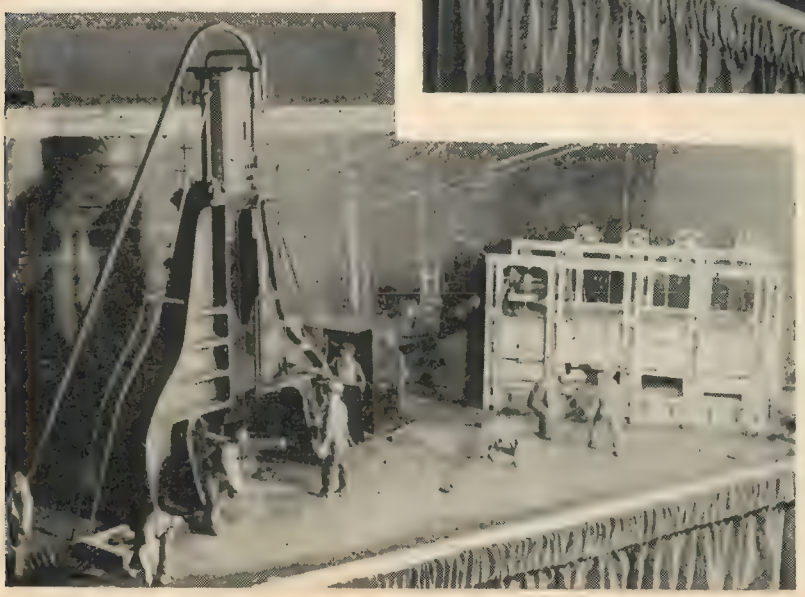
The pots are made of fire-clay, which was mixed by being trodden out with the bare feet; this, too, is still done where the process is still in use.

Modern Melting Shop

In the model of a modern melting shop, the inch-scale 6-ton Heroult electric arc furnace was made by L. W. Jones, of Smethwick. The prototype is used for producing large steel ingots and castings, the steel being melted under high voltage conditions, followed by a refining process under lower voltage. Careful current control is vital.

Modern "double-duo" electrically driven rolling-mill, with re-heating furnace in background

Below: Modern forging shop, with 4-ton hammer for forging ingots into billets, after re-heating



After this, the furnace is tilted, and the metal pours into a ladle, which the crane carries across to the casting pit. Here it is poured into the moulds through a stopper in the bottom of the ladle. The process is faithfully carried out (though considerably speeded up !) in the model, which also includes an exact reproduction of the melting shop equipment.

Modern Forge

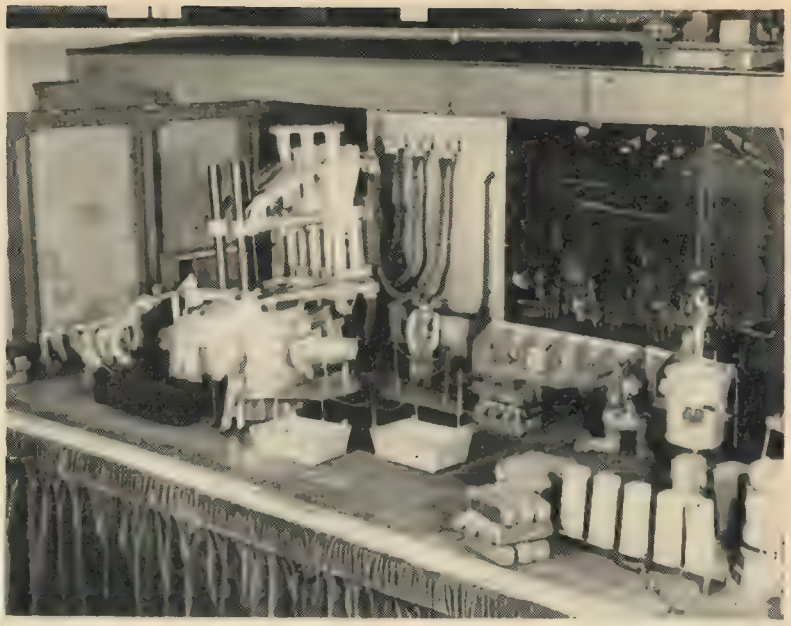
L. W. Jones also built the model 4-ton hammer in the modern forging shop, where the ingots are forged down into billets or slabs, suitable for the rolling-mill. The ingots are reheated in a furnace whose heats are carefully

controlled; the model furnace was built by Harlow Bros. of Sheffield. Here also the small details add considerably to the realism of the layout.

Modern Rolling-Mill

The prototype of the modern rolling-mill is built by the Brightside Foundry & Engineering Co. Ltd., of Sheffield, and is known as a "double-duo" rolling-mill. Here the billets from the forge, after reheating, are passed to the rolls *via* the overhead runway seen. They then pass through the upper rolls and back through the lower ones. After the rolling, they are hot-sawn to length, cooled and inspected.

In this bay, also, Harlow Bros. built the reheating furnace, and the replica of the rolling-mill in addition.



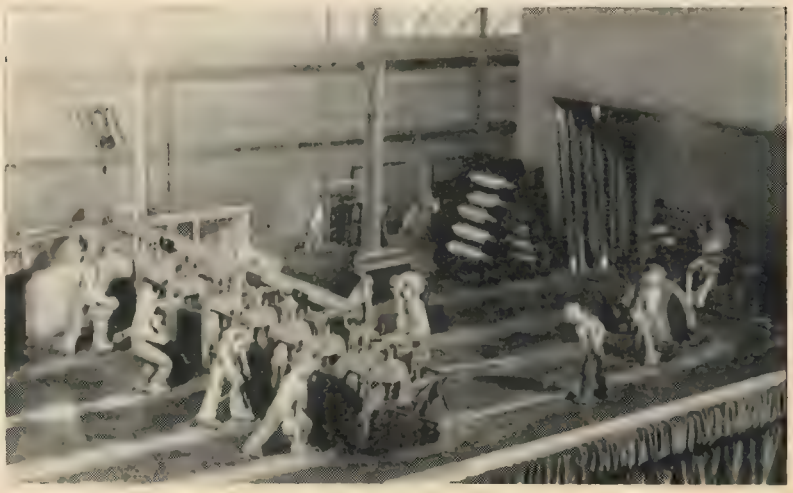
In this working model, mercury is used to represent the molten steel when the furnace is emptied. Note cast ingots and moulds in foreground

Another view of the 4-ton hammer and re-heating furnace, with weighing-machine for billets

and on return to this country it is to tour various centres, though unfortunately not for public exhibition.

[*Editorial note*: *The "dioramic" type of model is very useful in portraying scenes, and even processes, that cannot be inspected in full-size. The most interesting collection described in the foregoing article is all the more valuable in being made to work, thereby rendering the reproduction more complete; the models are unusual in this respect*]

Below: Another view of the modern mill, with rod being hot-sawn to right



Conclusion

In the description of the three modern bays, this has been in correct order of the processes, but it should be noted that the old-time processes should have been in the same order, namely, melting, forging, and rolling. However, the writer took the liberty of describing them in what was, to him at least, the most interesting. It is hoped that the reader will agree.

As already stated, all the figures in all the models were made at the Sheffield College of Art, and all photographs were taken by W. J. Hughes. Final co-ordination of the exhibits was done at Messrs. Osborn's own works by their own staff, and due acknowledgment is paid to the firm for permission to inspect and describe the models.

At the time of writing it is understood that the whole display is in Switzerland,

Making a Simple Beam Engine

SUBSIDIARY STRUCTURE AND MOTION WORK

By Edgar T. Westbury

AT this stage of construction, it is advisable to start preliminary erection of the parts so far completed, so as to locate the relative positions of the essential structural and working parts. As already mentioned, the prototype engine was mounted on a timber frame, but the model may be erected either on wood or metal, which in either case should be quite flat, and of thick enough section to be perfectly rigid. It is a good policy, however, to use a temporary base for the first erection of the engine, and leave the finished base until all fitting has been completed; the present arrangement, therefore, may be regarded as what a sailor would call a "jury rig," and aircraft fitters a "mock-up"—but the ancient millwrights I used to know would have said it was put together "tempo*airy*-like."

Many of the early beam engines were built in exactly the same way as this, being mounted temporarily on the floor of the fitting shop, and after completion, dismantled for final erection on site. Even in these days of mass production and working to limits, the method is not unknown for certain kinds of machinery, and for one-off jobs, it has the great advantage of enabling each part to be related to the rest without blind reliance on the infallibility of the draughtsman.

In the general arrangement drawings of the engine, neither the end elevation nor the plan were reproduced, as although they were necessarily laid out and drawn, they were not very informative as illustrations, as the details appeared rather confusing. The base plan given here, however, will enable the components to be erected in their correct places, and if a temporary base is used, any possible errors caused by slight discrepancies in the dimensions of working parts can be detected and corrected.

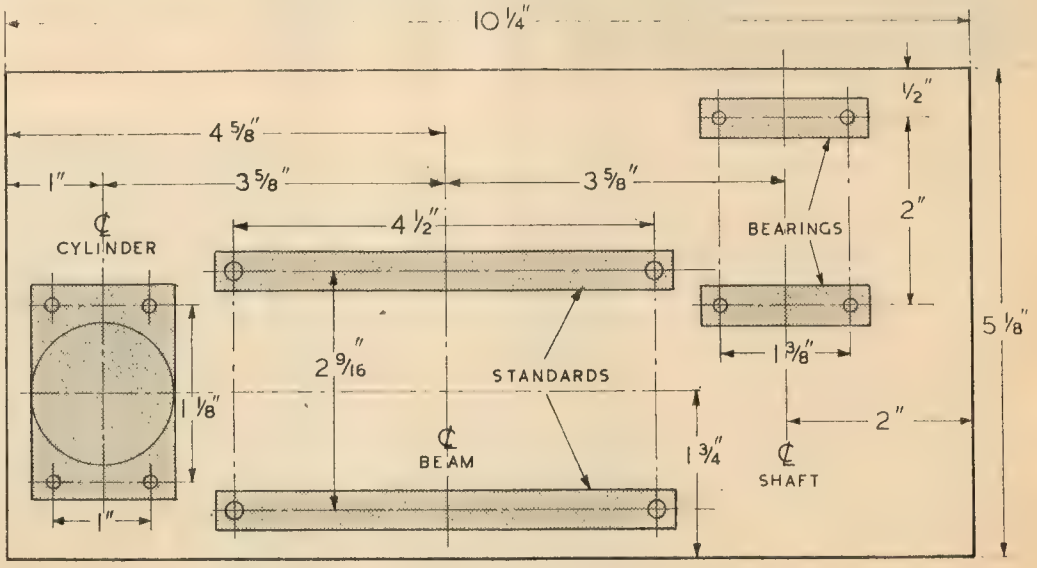
It should be noted that the external dimensions of the base given here do not allow for any coping or ornamental beading which may be added to the edges; remember also that clearance for the flywheel is necessary in any case, and some constructors may wish to fit an extra "pillow block" bearing outside the flywheel, in which case a wider base, with a gap for the flywheel, will be called for. Some readers have asked why I have not provided a cast metal bedplate, but apart from the fact that this would not be true to prototype, it would not give any scope for alternatives of this kind, not to mention the difficulty of machining such a bedplate, with the limited equipment normally available.

When erecting the standards, it is important that the bearings for the beam should be the correct distance apart, and it is thus advisable to fit a temporary tie-bolt between them—such as a piece of studding with lock-nuts on it—to enable this distance to be adjusted, before bolting the feet of the standards to the base. Needless to say, they must be exactly perpendicular in end view. It will be seen that the centre distances marked out on the base for the shaft and the cylinder respectively are less than the radius of the pivots of the beam; in case it is thought that this is an error, I will explain the reason for it.

The point is best illustrated at the cylinder end, though it applies at both ends. If the cylinder were located exactly under the radial point of the beam, the links connecting the latter to the piston-rod would be exactly in line, or at "zero angularity," at mid-stroke, but would have a fairly considerable angularity at both ends of the stroke. By displacing the cylinder centre by an amount equal to about half that produced by the arc of beam movement (i.e., the difference between tangent and arc at the ends of stroke) it is possible to split the difference, so that the links swing more or less equally inwards and outwards, thereby reducing their maximum angle to the piston-rod. Another example of the gentle art of compromise, which is so important a factor in engineering design.

The entablature (so-called) consists of a U-shaped channel girder, which

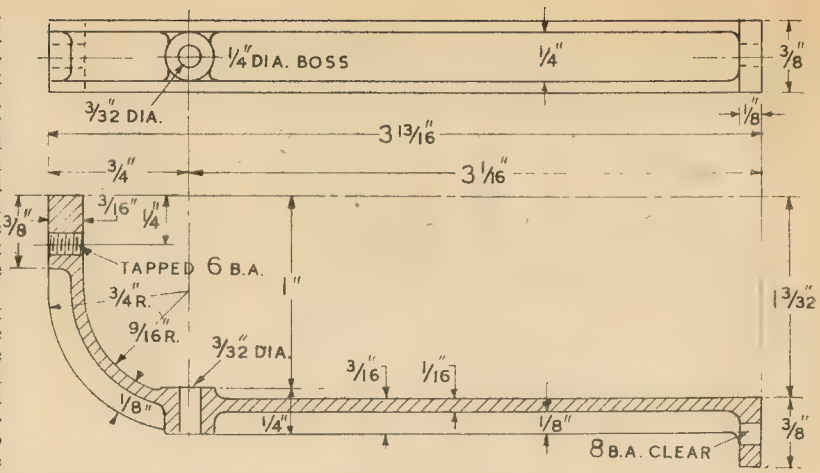
Continued from page 703, *December* 16, 1954.



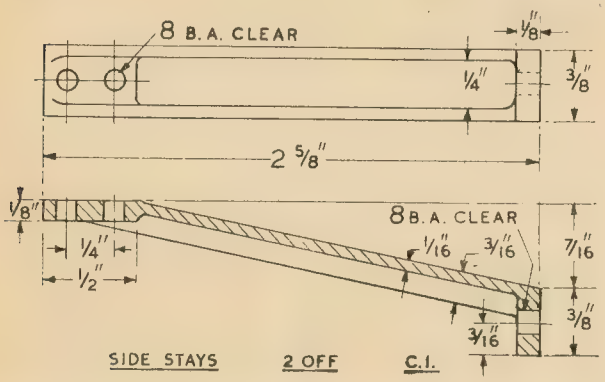
BASE PLAN, SHOWING LOCATION OF MAIN FIXTURES.

for convenience of construction is made in two halves, and may be fabricated if desired, though castings are appropriate and true to type. It need not necessarily be machined on the facings, as filing is satisfactory if carefully carried out, but it is fairly easy to mill them in the lathe by mounting on parallel packings on the cross-slide, and using a face mill or fly-cutter, which will enable the exact squareness of the faces to be assured. The butt joint where the half-frames meet should be similarly trued to ensure a close fit.

In drilling the holes for the link pivots, care should be taken to ensure that they are in cross alignment with the piston-rod, and also axially true with each other. To ensure this, a sound method is to join the halves in a temporary assembly, with the feet bolted to a flat plate and a strap clamped to the centre joint. The position of the holes can be marked off with a scribing block at $3\frac{1}{16}$ in. from the end face, and after centre-punching, are started with a small centre-drill, entered to a depth sufficient to give a positive location. They can then be drilled in the lathe, by running the drill in the chuck, and supporting each end in turn on the back centre. Use a short, stubby drill, and spot-face the holes both inside and out afterwards.



ENTABLATURE FRAMES 2 OFF C.I.



SIDE STAYS 2 OFF C.I.

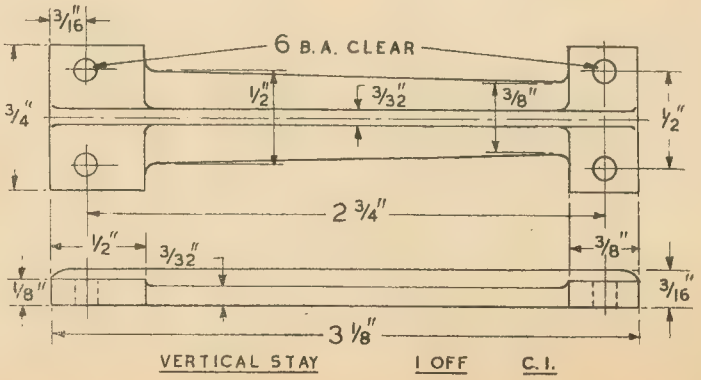
The vertical stay is in the form of a T-girder, which is also specified as a casting, and again calls for very little in the way of machining. Some constructors may consider that this stay is much less elegant than the turned column which was used on many engines of a later period; it is, however, true to prototype, though I do not think the alternative form would be considered incorrect practice. If a turned column is used, it will need the addition of angle brackets at each end to attach it to the vertical faces of the cylinder and entablature. When assembled, the latter must, of course, be exactly parallel to the base, i.e., horizontal.

Castings are also specified for the two side stays, which are fitted between the cylinder and the standards. These can also be either filed or milled on the bolting faces, and after drilling the fixing holes, may be used as jigs to locate the tapping holes in the mating parts.

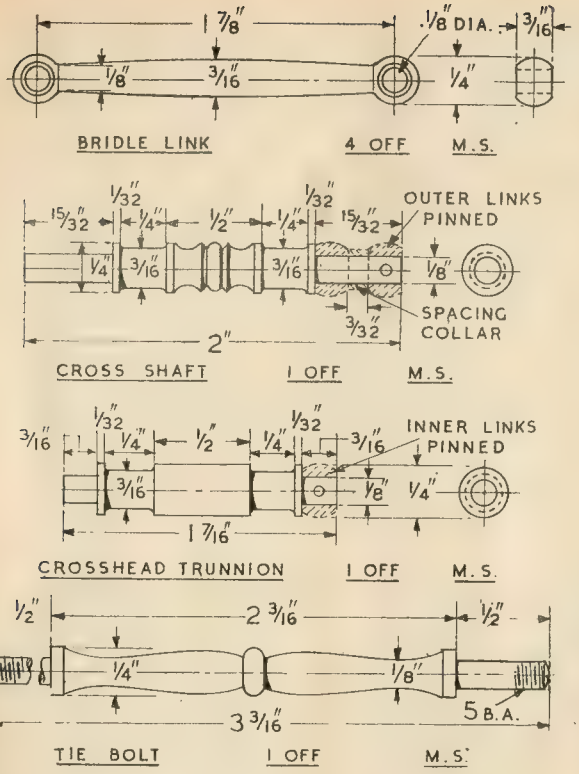
As already mentioned, some slight adjustment of the distance between the shoulders of the tie-bolt may be found necessary, and this should be checked from the temporary assembly. The bolt may be made from $\frac{1}{4}$-in. mild-steel rod, and after turning down and screwing the ends in the chuck, one end may be held in a tapped bush, while the other is supported by a hollow centre in the tailstock, for the remaining operations. These are best carried out with hand tools, though it will be helpful to use slide-rest tools for necking down near each end and vee-notching at the sides of the centre bead. It should be noted that the "chair-leg" decoration of the few turned parts was characteristic of most of these old engines, except the very primitive types which were produced almost entirely by the art of the blacksmith. The early turners, to whom the slide-rest was a novelty, often regarded as fastidious and unnecessary, had in many cases learned their craft in wood-turning shops, and liked to take every possible opportunity of putting in a few bits of ornamentation—it was easier than straight contours when using hand tools!

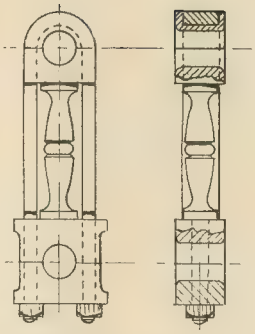
Crosshead Trunnion

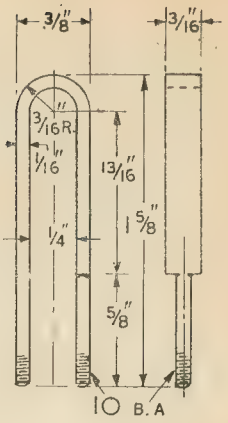
This may be turned between centres, if desired, though the centres should be small and unobtrusive, or machined away altogether afterwards; it will, however, be easier to machine it all over at one setting and part off, from a rod held in the chuck. If the latter is reasonably true, $\frac{1}{4}$ in. diameter bright mild-steel may be used, and will not require touching on the centre portion and collars. The journals must be quite parallel and smoothly finished, and



VERTICAL STAY 1 OFF C.I.







the end spigots may be left a thou or so over size for fitting to the eyes of the links.

The cross shaft can be dealt with in much the same way as the trunnion, the end portions in this case being lengthened to accommodate two links, plus a spacing collar, the inner link being a running fit. The method of fitting these links should be noted; the inner links are pinned to the trunnion, but free to articulate on the cross shaft, while the outer links are pinned to the cross-shaft but articulate on the pivot bolts, which are fixed in the inside of the entablature frame. To prevent the links fouling each other, collars are fitted between them on the cross-shaft; it has not been considered necessary to show these in detail, but their position is clearly indicated on the detail drawing. They can be made by drilling and reaming a $\frac{1}{8}$ in. central hole in $\frac{3}{16}$-in. mild-steel rod, and parting off at a length of 3/32 in.

In some of these articulating parts, here and elsewhere in the motion work, it has been necessary, in the interests of simplicity, to use steel shafts working in steel eyes, which is not the best possible engineering practice, but the amount of motion is very small, and if the parts are kept lubricated, I do not anticipate any trouble with seizure or excessive wear. If, however, one wishes to eliminate this remote contingency (and incidentally produce an engine which will last for ever !), the shafts in each case can be case-hardened.

Bridle links, sometimes known by the alternative title of radius rods, are made of mild-steel, by exactly the same methods as those employed for the links of the valve gear, already described. Great care should be taken to ensure that the distance between the centres of the eyes is the same in each case, and this should also correspond with the distances between the pivot centres in the beam.

Suspension Links

These constitute what many constructors may regard as a "fiddly sort of job," as they are of composite structure, and call for careful detail work. I do, however, exhort all those who value fidelity not to grudge this trouble, as any attempt to simplify this highly conspicuous feature of the design is almost certain to impair appearance. I have seen some most appalling errors in the details of the parallel motion in models which were in other respects well made and correct in detail; in some cases links were made out of solid pieces of flat bar, and, in one model I encountered, the material used was duralumin, highly polished ! If one compares this with the delicate detail work in the motion of full-sized beam engines, the enormity of the crime is apparent.

As shown in the assembly drawing, each of the four identical links is built up of four parts, one of which, the outer strap, is of mild-steel, while the rest are of bronze. I have taken a liberty with the detail design, in making the centre pillar, or stretcher, integral with the upper and lower half-bearings. This would, in the full-size engine, be a separate piece, with spigots on each end to register in recesses in the brasses, but, if this construction is adhered to, the link will require six separate pieces instead of four. I believe my simplified design, which does not affect appearance, will be quite satisfactory and much easier to make; but constructors may, of course, please themselves which method they adopt.

Link Strap

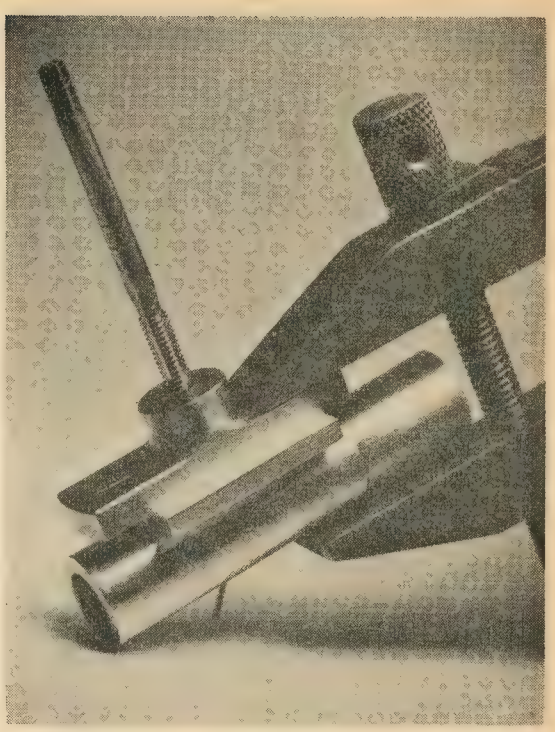
This is made from $\frac{3}{16}$ in. by $\frac{1}{16}$-in. steel strip, and, before bending to U-shape, it should be set up in the four-jaw chuck, exactly true, and the ends turned down and screwed 10 B.A. The exact length of material necessary to form the strap may not be easy to assess, owing to the stretching which takes place on bending, but a test may easily be made with a bit of scrap material of known length. The screwed part must of course be long enough to enable the strap to pull down on the top bearing before the shoulder bears on the lower one, but a large gap here is undesirable, and should be avoided if possible. It is fairly easy to bend this light material cold, and hammering should not be necessary. A piece of steel bar $\frac{1}{4}$ in. thick, with a carefully rounded-off edge, may be used as a bending jig, and care must be taken to get the bend exactly central, so that the screwed ends are equal in length. In the event of any correction of the bend being necessary, normalise the steel by heating it to redness and allowing it to cool slowly, to avoid risk of fracture, both before straightening and also re-bending.

Link Centre

The major portion of this may be made from a bar of $\frac{1}{2}$ in. by $\frac{1}{4}$ in. section; if a casting is used, it should be squared up first, though not necessarily to finished size at this stage, and it should be faced off exactly to length. Similar material is used to form the bottom half-brass, which, after facing

(*Continued on page* 768)

Photograph No. 3. Holding guide down with finger and thumb



Photograph No. 4. Clamping the guide in position

make a new set ! Drill all the holes to one size larger, retap and make only the smallest size again.

Finally, it may be that some of the "old hands" object to using a gadget for such a job My answer is, that there is, and always will be, room for hand skill in model engineering, but let the gadgets do the routine work if they do it better. We can, I think, always use our hands to some better advantage elsewhere.

MAKING A SIMPLE BEAM ENGINE

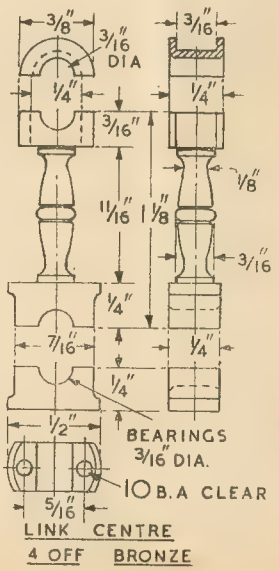
(*Continued from page* 766)

top and bottom, may be secured to the main part by drilling the fixing holes and fitting temporary screws. A centre for supporting the assembly when turning may be drilled in the end face.

By holding the component by the upper end in the four-jaw chuck, and supporting it by the tailstock centre, it may now be turned on the outside, including the pillar and the edges of the lower bearing. Take care to make all four parts as near as possible identical in appearance, and absolutely the same in length between bearing centres.

Special Treatment

The upper half-bearing requires special treatment, and I recommend that it should be made in the same way as employed for complete split bearings; that is, by splitting a piece of round bar, facing the joint surface, and sweating together, then turning the outside (but not boring the centre) and parting off. A little extra thickness should be left on the flanges for final finishing, but



the centre should fit exactly, both on diameter and length, in the bend of the strap. Two of these pairs should be made, and, when unsweated, will provide the four half-bearings.

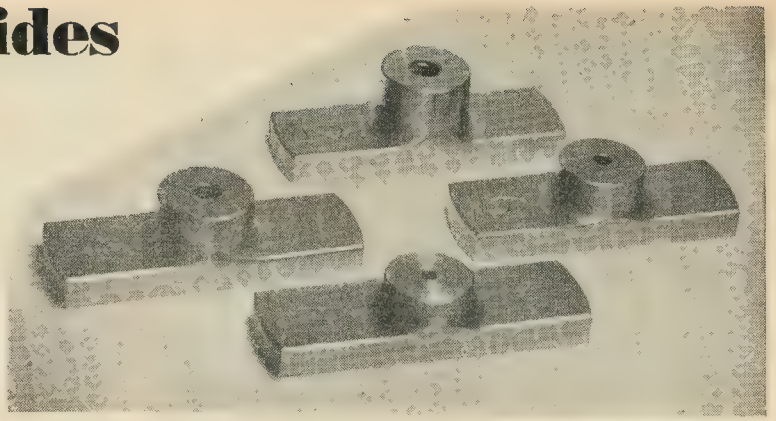
The upper half-bearings may now be sweated in place on top of the link centres, taking care to get them exactly square and symmetrical, and the sides of the top bearing may then be milled or filed down to coincide with the width of the half-brass, including the groove to fit inside the strap.

To bore the eyes of the bearings, the link should be fully assembled and the strap tightened up, after which it can be set up on the faceplate for boring one end. In boring the other end, a simple jig with a close-fitted locating pin, such as described for similar operations on other components, will ensure not only exact parallelism, but also uniform length between centres. The sides can be faced to finished width by mounting the eyes on a pin mandrel.

(*To be continued*)

Tapping Guides for Small Diameters

by J. Newbert



Photograph No. 1. A set of B.A. tapping guides

THERE are but few of us, I imagine, who would not admit to difficulties, sometimes, in tapping small diameter holes. If we are frank, we shall also admit to one or two second attempts at this job, for it can be difficult even with experience to exert an even pressure on both sides of the wrench, keep the tap vertical and at the same time maintain the correct downward pressure to give full and true thread. When, in addition to being of small diameter, the hole is also both shallow and "blind," the difficulties can be very real. Even the more experienced of us may sometimes be forgiven a sigh of relief, and perhaps a self-congratulatory pat on the back, for having successfully made a good job of the thread. Having been by profession an engineer, and responsible for supplying the "know how" to numbers of young intending engineers, I pass on my method of helping them to overcome this hurdle, which I also use myself. The device is extremely simple to make, as a glance at the drawing will show. It is just as simple to use, too.

Each guide is made from a length of bright mild-steel $1\frac{5}{8}$ in. × $\frac{1}{2}$ in. × $\frac{1}{2}$ in.

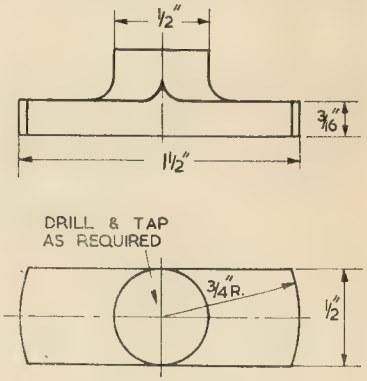
Photograph No. 2. A tap and guide ready for use

Commence by marking-out the centre for the tapped hole. Set the block up in the lathe, using a four-jaw chuck, so that the "popped" centre runs true, and the block projects about $\frac{1}{4}$ in. from the jaws. This done, skim up the face perfectly true with a light cut, and centre again for the drilled hole. This centring is best done with a tool in the toolpost, but if the lathe and drill chuck are in good order, a centre-drill will do the job satisfactorily. Next, drill and tap the required hole, taking particular care over this latter operation, which is done in the machine. Finally, skim the ends of the block, to give a length of $1\frac{1}{2}$ in. overall. Turn the job round in the chuck, and, holding the sides and the two turned ends, with the hole running true, the boss and the upper faces may be turned to size. The truth of these upper faces with the hole cannot affect its accuracy in use, but of course appearance and workmanship mean a lot, so "nuff sed."

A set of B.A. guides so made is shown in Photograph No. 1, and as you will see, they are numbered on their upper surfaces with the size of the thread: No. 2 B.A. to No. 8 B.A. You will have noticed, of course, that no dimension is given for the height of the boss. This varies with length of the tap, since it is necessary for each taper tap, whatever its diameter, to cut two or three full threads at least, when screwed through the guide as far as it will go. You will, therefore, have to vary this height for each particular size of tap. A glance at the photograph will show the varying heights in the B.A. set.

The guides are very simple to use, and the old phrase: "A child can use it," is literally true. Insert the tap in the guide so that the end just appears, and can locate in the hole without undue pressure or slackness. Photograph No. 2 shows the guide and tap ready for location in the tapping hole. Thereafter, the tap and guide may be held down with the finger and thumb of one hand, as in Photograph No. 3, and the tapping done as usual. Alternatively, they may be held down with clamps, as in Photograph No. 4. This is a better way for harder materials or for "blind" holes. In actual fact, this last photograph shows a hole being tapped to receive the pivot pin on the cylinder block of an oscillating steam engine, a typical job which the guide does perfectly, but which is somewhat "tricky" otherwise.

A little study given to the movement of the tap as it passes through the guide will show some of the advantages to be gained by using it. Since the axis of the threaded hole is perfectly vertical, a vertical thread must result, and further,



A tapping guide (B. M/S)

since the tap cannot move sideways, "bell mouthed" holes and stripped top threads cannot result. In addition, as the tap cuts its thread, it is always moving downwards at its correct pitch. Thus, too much or too little downward pressure is not possible, and so you have a full thread right from the start of your hole.

The width of the guide being only ½-in., permits of holes being tapped whose centres are only $\frac{1}{4}$ in. away from projections or shoulders, often a convenience to model engineers. For extra awkward places, one "wing" of the guide may be removed, when, of course, clamping down is a necessity.

When, after use, the set of guides become worn, do not scrap them and

IN THE WORKSHOP
BY DUPLEX

Making a Lathe Boring Head

WHERE the lathe is fitted with a boring head of the kind illustrated in Fig. 1, castings and other workpieces too large to swing in the lathe gap can be readily machined when mounted on the lathe saddle. The longitudinal feed is then obtained by traversing the lathe saddle, and the radial feed or setting of the tool is provided by the slide incorporated in the boring head itself. Furthermore, an automatic radial feed of the tool is easily arranged by fitting a toothed star-wheel to the feedscrew of the appliance, and rotating this wheel, a tooth at a time, by means of a striker attached to the lathe bed or headstock. When designing a boring head for a small lathe, two essentials should be borne in mind, namely; a fine feed is necessary to give satisfactory machining, and the possibility of the star-wheel jamming against the striker must be avoided.

The first requirement is met by fitting a feedscrew of 40 t.p.i. in conjunction with a star-wheel having ten teeth; this gives a radial feed of only $2\frac{1}{2}$ thou in. for each revolution of the mandrel. To meet the second requirement, the striker is fitted with a relief mechanism which also allows the feed to be engaged or disengaged at will during the machining operation.

In addition, in order to maintain rigidity, the overhang of the boring head must be reduced as far as possible, and the moving slide must be capable of being securely locked in position.

Apart from the projecting length of the tool, the present head has an overhang of $1\frac{1}{2}$ in. beyond the end of the mandrel nose.

A wide range of radial movement of the tool is an advantage and, here, the slide has a travel of 1 in., but an additional outward setting is obtained by swinging the attachment on its base mounting. As will be described later, the head is fitted with two or more different types of tools, so that boring and internal screwcutting can be carried out, as well as external turning, facing, and screwcutting.

The Mandrel Mounting

To save unnecessary work, the boring head was mounted on the catchplate of the Drummond lathe; but, by so doing, this lathe fitting was in no way made unserviceable for its normal purpose. All that is needed is to drill an additional $\frac{3}{8}$ in. diameter hole to take the bolt on which the base of the head pivots. As an alternative, a small chuck backplate can be substituted for the catchplate, but the ordinary face-

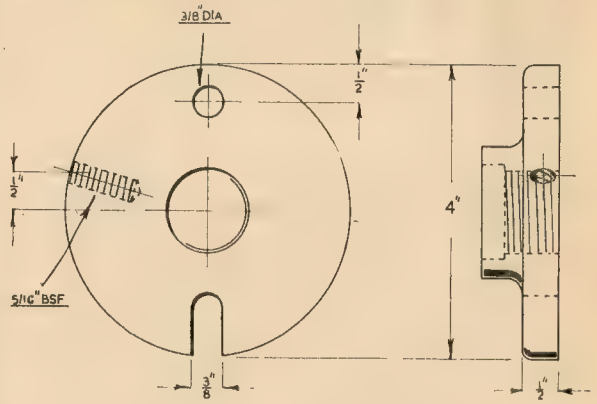


Fig. 2. The lathe catch-plate mounting

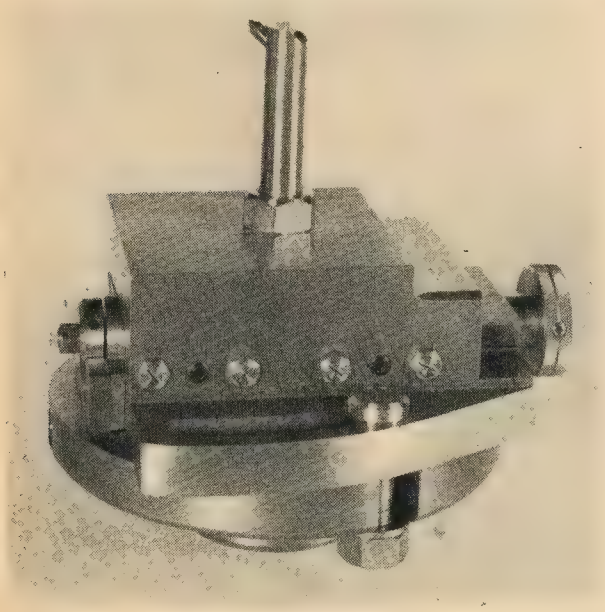


Fig. 1. The finished boring head

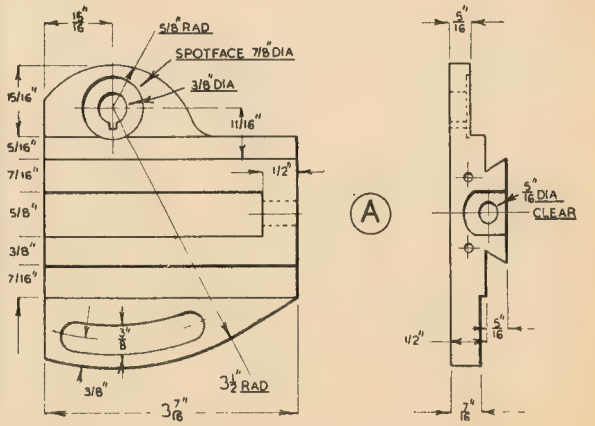


Fig. 3. The base casting

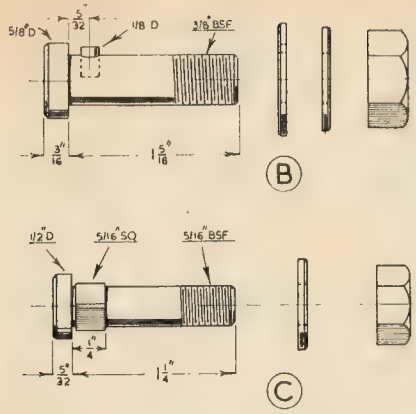


Fig. 4. The two attachment bolts

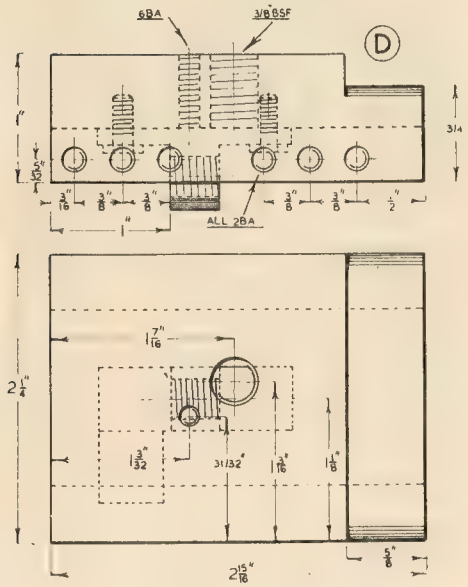


Fig. 5. The slide casting

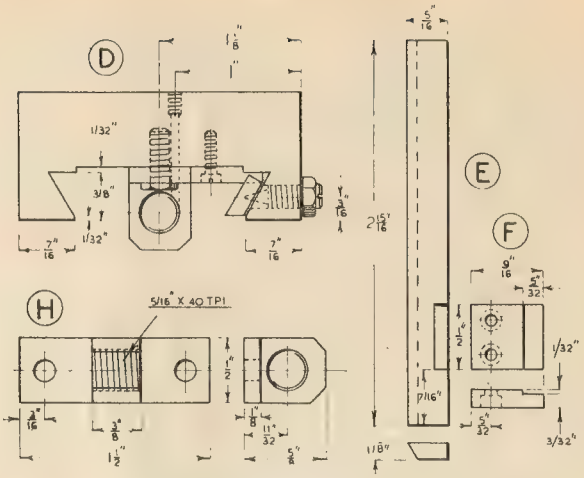


Fig. 6. The gib-strip—E; the gib locating plate—F; the feed-nut—H

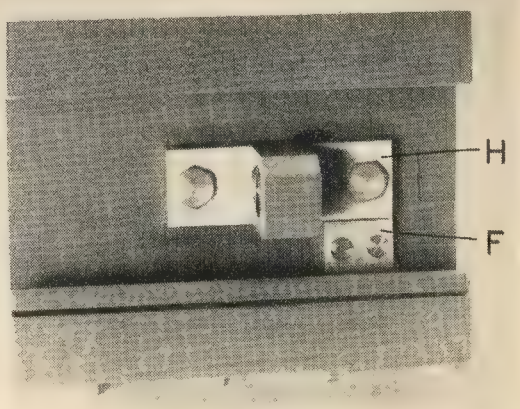


Fig. 7. Showing the position of the feed-nut and the locating plate

plate will be found too cumbersome.

The Boring-head Base—A

For making the base and slide of the attachment, the castings for the topslide of a 3-in. lathe were used and modified as required. As will be seen, the slide base is furnished with a curved slot; this enables the base to be rotated on its pivot-bolt and swung outwards to increase the cutting radius. This feature also allows the whole length of the slide to be kept in contact with the base during most machining operations. The pivot-bolt *B* is fitted with a snug under its head to keep it from turning when the nut is tightened. The other attachment-bolt *C* is made square under the head so that it can slide in the slot without turning.

The Slide D

The casting forming the slide is cleaned up all over, so that painting is not required. The under surface is machined flat, and the V-ways are cut at the same setting.

The mild-steel gib-strip *E* should be scraped flat on its working surface, and the adjusting-screws are then fitted as shown in the drawing. The screw holes are best drilled with the slide assembled on its base, and the gib-strip wedged in its working position; the holes for the two locking-screws are also drilled and tapped at this stage.

The gib adjusting-screws should be pointed to an acute angle of some 45 deg., so that they bear on the centre-line of the gib and do not push it out of position. It is important, in order to maintain the adjustment of the gib, that the adjusting-screws should be fitted with lock-nuts.

As the slide, whenever possible, is kept locked during machining operations, separate locking-screws are fitted, so that the setting of the adjusting-screws, once made, need not be interfered with.

It is also advisable to provide for end-location of the gib-strip; otherwise, wear of the points of the adjusting-screws may necessitate making frequent adjustments to the slide.

To constrain the gib-strip endways, but in no other direction, a small plate *F*, fitting closely in a gap filed in the strip, is secured to the under side of the slide, as shown in Fig. 7.

After the upper surface of the slide has been filed or machined flat and square with the under side, the hole to receive the toolpost is drilled and tapped $\frac{3}{8}$ in. B.S.F. or 26 t.p.i.

The adjacent oil hole for lubricating the feedscrew should be drilled at a later stage, after the feed-nut has been fitted.

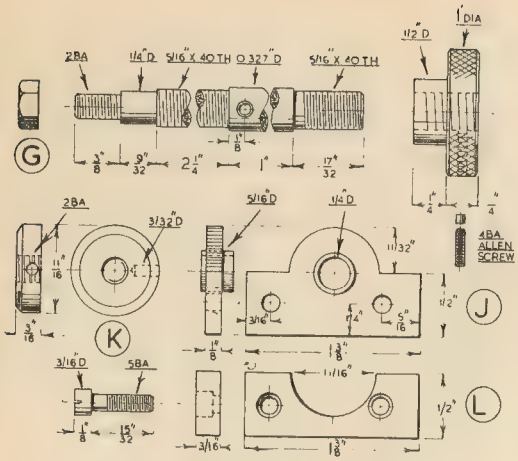
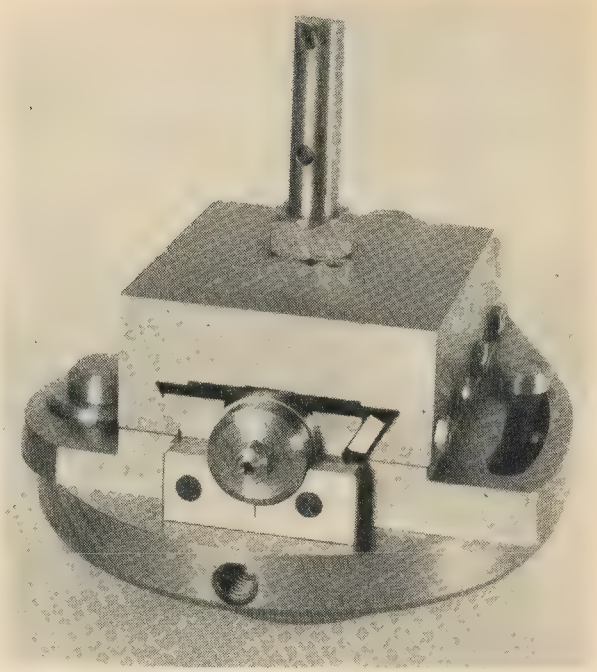


Fig. 8. The feed-screw—G; the keep-plate—J; the index collar—K; the index plate—L



Right: Fig. 9. End-view of the boring head

The Feedscrew—G

The mild-steel feedscrew is turned between centres and the 40 t.p.i. thread should be screwcut to ensure smooth working. The knurled finger-wheel, for actuating the slide, screws on to the end of the feedscrew, and is secured with an Allen grub-screw. The cross-drilled tommy hole, which is also drilled through the base, is for the purpose of holding the feedscrew during assembly of the other parts.

The Feed-nut—H

After the nut has been machined to shape, it is secured to the under side of the slide with two hexagon-headed screws. The nut centre is marked-out either by direct measurement from the datum faces of the slide, or by inserting a drill in the previously bored feedscrew bearing in the base casting. The slide can then be mounted on an angle-plate, attached to the lathe faceplate, for boring and threading the nut.

If, after assembly, the slide does not move freely for the full length of its travel, the holes for the screws securing the feed-nut may have to be eased to correct the alignment.

The Keep-plate—J

This part is filed to shape from $\frac{1}{8}$-in. steel strip, and then drilled for the shouldered bush, which is pressed into place. The holes for the attachment-screws are also drilled. The keep-plate is now put in place on the feedscrew, and clamped in position with a nut and washer, so that the holes for the fixing-screws can be drilled and tapped in the casting. Again, these holes may have to be eased slightly to afford free working of the slide. However, in the interests of good workmanship, this should be avoided if possible, and in the present instance, neither these holes nor those in the feed-nut needed any correction.

The Index Collar—K

The small index collar screws on to the end of the feedscrew, where it is locked in place by a nut, after the end-play of the feedscrew has been adjusted. As the feedscrew is threaded 40 t.p.i., the index is engraved with 25 graduation lines, each equivalent to a feed of 1 thou in.

The bevelled face of the collar is machined by setting over the top-slide, and the graduation lines are cut with a V-tool at the same setting of the slide. A 25-T. change wheel secured to the tail of the mandrel, and controlled by a detent, provides an easy means of indexing the collar. Finally, the numerals are marked on the bevelled face with hand-stamps.

The Index Plate—L

As can be seen in Fig. 9, the index plate, with engraved zero line, is assembled on the face of the keep-plate.

After the part has been filed to shape, it is clamped to the keep-plate, so that the latter serves as a guide for drilling the holes for the fixing-screws.

Lubrication

Oil can be applied directly to the feedscrew bearings, but to lubricate the feed-nut, an oilway, sealed with a grub-screw, is drilled into the nut from the surface of the slide, as shown in Fig. 6.

(To be continued)

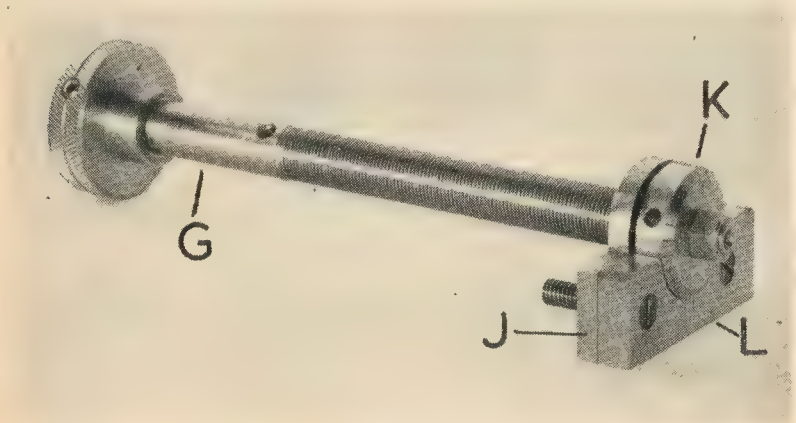


Fig. 10. The feedscrew assembly. The keep-plate—J; the index collar—K; the index plate—L

Built-up Milling Cutters

By R. Harries

MANY amateurs possess small milling machines, but it is not unusual to find that their stock of milling cutters to go with the machine is somewhat limited, which is understandable when one considers the high price of these commodities today. In particular, the larger face milling cutters are noticeably absent, and this article gives some ideas on how this type of cutter can be fabricated by the built-up principle, using inserted teeth to economise in tool steel.

Simple Type

An effective little cutter for the lighter class of work can be quickly made from an ordinary hexagon-headed steel bolt of large diameter. The design is shown in side and end elevation in Fig. 1, from which it will be seen to consist of the bolt *A*, the head of which has three holes to carry the inserted silver-steel cutters *B*. The latter are held by the side-screws *C*.

In making this tool, first centre-drill the shank end and the face of the bolt, so that the latter can be mounted between centres on the lathe. Now skim the shank parallel, if the cutter is to be held in a chuck, or else to an appropriate Morse taper if the shank is to fit into a taper bore. Also turn a shallow V-groove in the face of the bolt head, on which the centres of the inserted teeth will come, so as to aid marking-out the hole positions, and ensure that each tooth will operate on the same radius, and therefore carry an equal load of cutting.

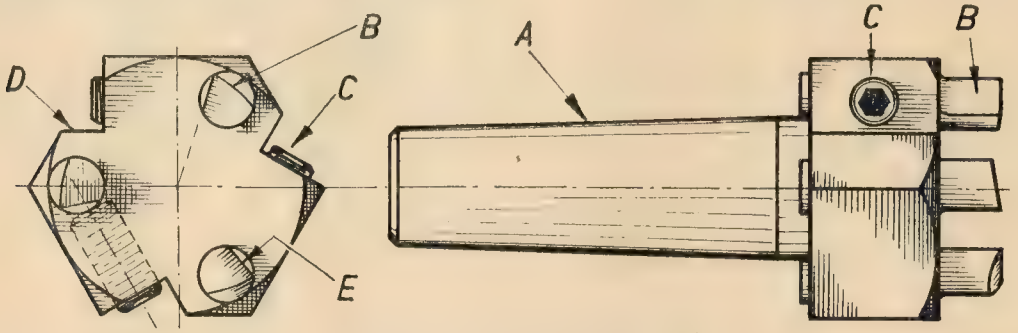


Fig. 1. Small face-cutter made from a bolt

Mark off three radial lines to intersect the above V-groove, centre-pop these positions, and drill for the cutter bits *B*. File out the three nicks *D* to give a square face to start drilling on, and tap for the three clamp-screws *C*.

Now cut off three lengths of silver-steel rod for the cutter bits. On the projecting portion of each, file a flat to represent the top face *E*. Clamp the three cutters in the body-piece so that this top face forms a top rake of 5-10 deg. (see Fig. 2). This can be done very easily by drilling axially down the centre hole, and inserting therein a small diameter plug against which one can register an offset straight-edge (Fig. 3). The latter is quickly made by soldering together two pieces of strip material. Now mount the body-piece, with cutters attached, between centres in the lathe, and skim the ends of each cutter, and also the periphery, as per dotted line *F* in Fig. 2. Remove from the lathe, and twist each cutter round in its hole so that its top face now comes radial, Fig. 4. This can be done again by using a special little stepped straight-edge, registering against the same central plug. The effect of twisting the cutter is to produce automatically the necessary side clearance, as can be seen from Fig. 4.

Front clearance is provided by hand-filing, so as to slope back the surface below the top radial face. If care is taken with these operations, the cutting action of each tooth will be reasonably balanced. Harden each tooth, and temper to a light straw.

Multi-toothed Model

The greater the number of teeth there is in a cutter head, the smoother is its action and the less the cutting load on each individual tooth, for a given power input.

If the bolt head is large enough in diameter, it is possible, by using an alternative clamping method, to accommodate twice as many cutting teeth, i.e. six. Figs. 5 and 6 show how this is done.

In the end view, Fig. 5, it will be seen that there is a cutter bit *A* near each corner of the bolt head. Entering a hole in the centre of every alternate flat face is a silver-steel rod *B* of such a diameter that the holes for the pair of adjacent cutter-bits intersect it. The inner end of *B* is domed where it enters an axial counterbore *C* (Fig. 6) in the bolt end, and bears up against

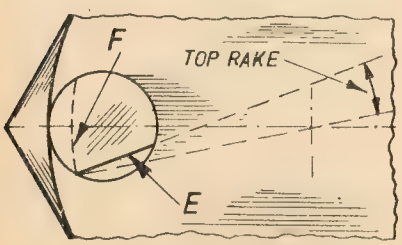


Fig. 2. Position of inserted tooth for forming clearance

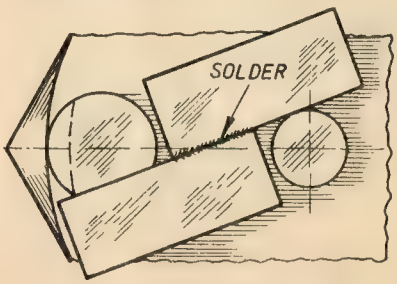


Fig. 3. Special straight-edge and register plug to facilitate setting cutter

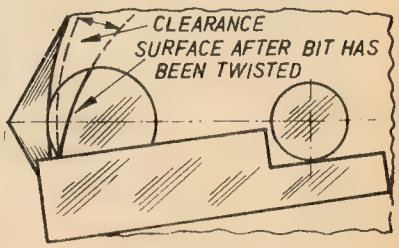


Fig 4 Stepped straight-edge used for final setting of tooth

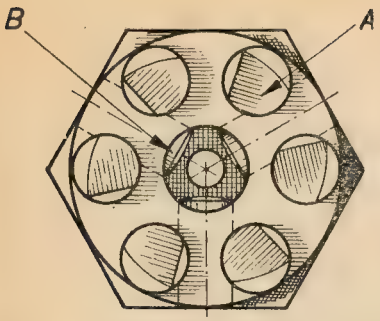


Fig. 5. A six-toothed facing cutter in end view

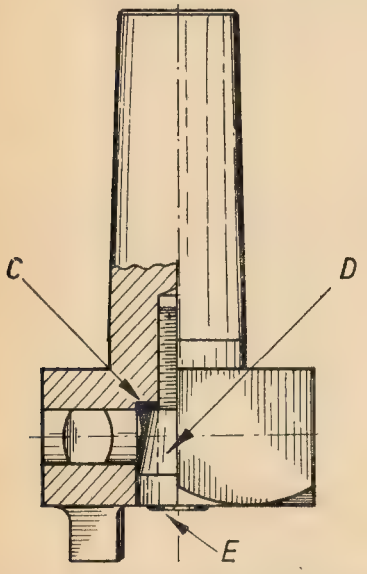


Fig. 6. Six-toothed cutter in side elevation partly sectioned

the sloping face of a sliding conical sleeve *D* passing over the stud *E*. The action of tightening *E* is to draw in the sleeve *D*, whose sloping face pushes out the three rods *B*, thus clamping the six cutters *A*.

For the successful operation of this clamping idea, a certain amount of freedom of fit of parts *D* and *B* is desirable, so that the float obtained will enable each rod *B* to bear on its pair of cutters. The cutter-bits are shaped in the same way as for cutter Fig. 1. Besides hardening the cutter-bits, it is advisable to harden rods *B* and sleeve *D*.

A modification to the above cutter can be made to bring the cutting teeth tips outside the boundary of the bolt head and thus permit the cutter to operate against deep shoulders. This consists of drilling the cutter-bit holes at a slight angle, as indicated in Fig. 7, so that the lower ends of the cutter-bits are proud of the boundary of the bolt head. The construction of this type of cutter, however, calls for more careful workmanship, and the cutter-bits are a little more tricky to shape accurately.

Large Diameter Cutters

Large diameter face cutters, with a greater number of teeth, necessitate a larger body-piece, which can be made from a slice off a mild-steel bar. Such a head will have to be bored and threaded to accept a separate arbor of appropriate taper. One arbor will suffice for several detachable heads, however.

If round bits of cutting steel are used for the inserted teeth, they can be secured in one of the various ways shown in Fig. 8. At *A* is indicated the slimplest method of holding the bit, namely, a side screw, bearing direct on the cutter. It is advisable to provide a flat on the bit where the screw bears, so as to stop the former rotating in its hole.

The second method *B* makes use of a taper plug driven radially into a taper reamed hole in the body, and cutting across the side of the cutter-bit. The small end of the peg enters a hole drilled at right-angles, into which can be inserted a taper drift for driving out the peg.

Another neat method of holding cutter-bits is that at *C*, where it will be seen that in every alternate space between a pair of cutters, three radial saw cuts are made—the two outer cuts intersecting the cutter-bit holes and the centre one having a taper hole passing

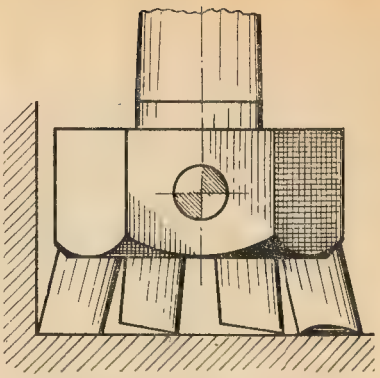


Fig. 7. Splaying teeth to reach into a corner

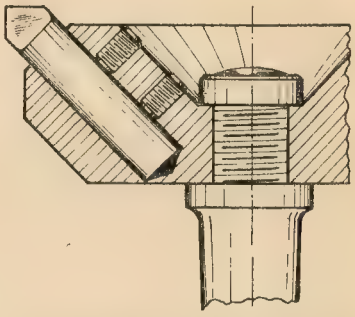


Fig. 9. Obliquely-set teeth to permit milling up to a corner

through it at right-angles. Into this latter hole is driven a taper peg, so as to force apart the two thin springy portions so formed, and thus cause them to bear down on the cutter-bits.

The last clamping method is shown at *D*. Here a sleeve enters a radial hole passing between a pair of cutter-bits. This hole intersects each cutter-bit hole. A retaining-screw forces the sleeve inwards, and the latter, being shaped on its lower edge to fit against the cutter-bits causes them to be held tightly.

The four securing methods described above show the cutter-bits lying parallel with the axis of rotation, and thus do not permit the cutter to be used for

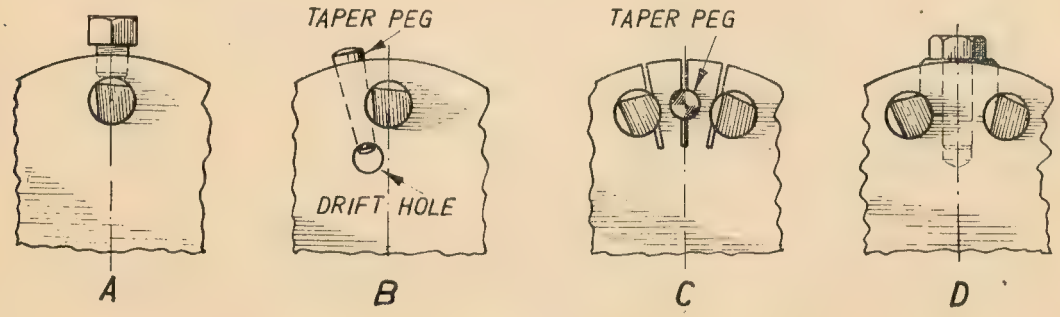


Fig. 8. Four methods of securing round section cutter bits

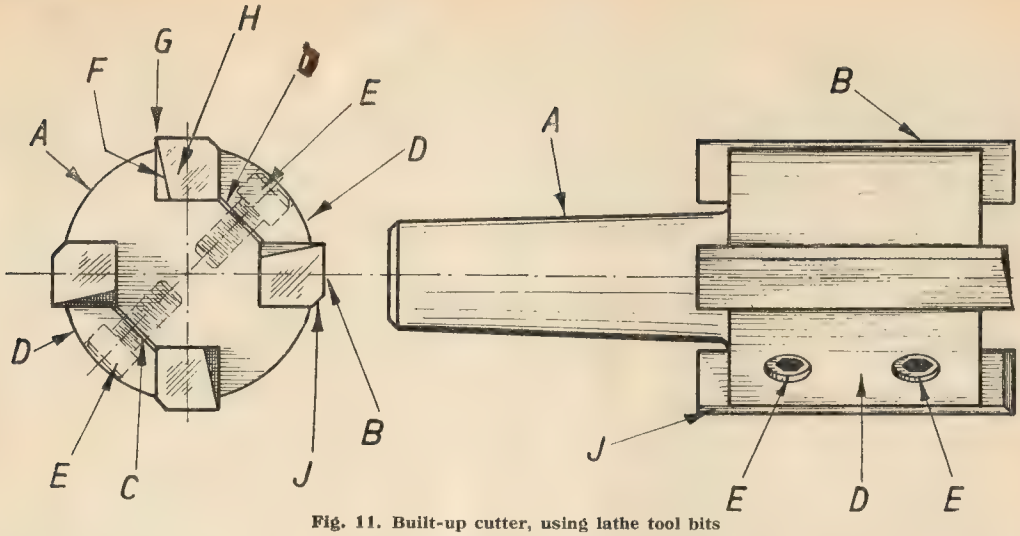


Fig. 11. Built-up cutter, using lathe tool bits

milling up to a corner. Should this latter operation be required, then the bits will have to lie at an angle to the axis of rotation, and it is suggested that they be secured in the manner shown in Fig. 9, which is self-explanatory.

Cutters with Square Bits

Square section H.S. tool-bits, as used for lathe turning, make excellent inserted teeth for milling cutters, and last much longer than silver-steel bits.

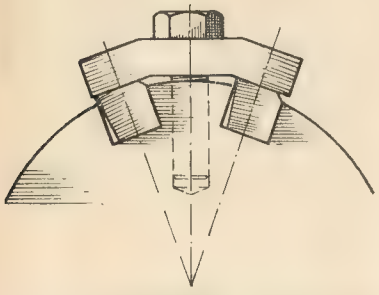


Fig. 10. Clamping square-section bits with a bridge plate

They are available from $\frac{3}{16}$ in. square upwards.

Similar body-pieces are used as for the round bits, and the seatings for the bits are milled across the periphery. It is essential that the bits be a good fit in their respective slots, as no wobble can be tolerated. The simplest method of holding down the bits in their slots is indicated in Fig. 10. The slot is milled to such a depth that the bit just stands proud of the periphery of the body. A clamping plate bridges a pair of bits and is drawn in radially by a central screw. If the slots are machined at an angle to the axis of rotation, so that the bits splay outwards enough at their cutting end, then the cutter will undertake side as well as face milling.

A very neat built-up cutter of smaller diameter for side and face milling can be made as shown in Fig. 11. The body-piece *A* consists of a cylindrical portion, with an integral taper extension arbor. Four slots are milled on the periphery, parallel with the axis and on the centre-line. The depth of the slot is such that the H.S. cutter-bit *B* just stands proud of the body. Now make two saw cuts *C* down the length of the body so as to form two clamping plates *D*, which hold the cutters in place by the socket-screws *E*.

The cutting faces are ground on the end of the cutter-bits by first grinding the forward face *F* radial, taking care not to go beyond the corner *G*. About 10 deg. clearance is then put on the face *H*. The trailing corner *J* should be ground off, or else it will rub. Subsequent sharpening should be done on the face *H* only.

Wherever possible, it is advisable finally to touch up the cutting edges of the inserted blade cutters, by chucking the latter in the lathe and using a grinding attachment in the toolpost. By this means, one ensures that each tooth cuts the same amount, resulting in smoother running and a better finish to the work surface.

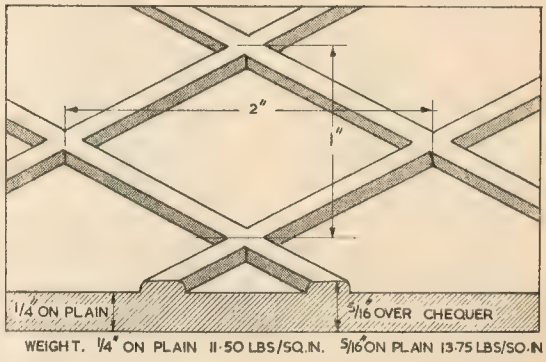
Chequer-plates

I have been following the letters written regarding the above subject.

I do not claim to be an authority on the matter, but can give a few facts about it. First, there are only two recognised manufacturers in this country, and the full range of sizes runs from $\frac{3}{16}$ in. to 1 in. thick, up to 66 in. wide and 30 ft. long. I believe that the chequer in all cases is $\frac{1}{16}$ in. over plain, and there are two main types made, " Admiralty Pattern " of which I give a full scale sketch, and the "open type," produced, I understand, with the idea that they would not retain oil, etc., and be easy to clean. In the " open type " chequer, the pattern seems somewhat closer and squarer than the Amiralty job, but the raised portions are tapered at the ends and leave about $\frac{3}{8}$ in. clear at the point where they should intersect.

I have no intentions of trying to reproduce miniature chequer-plates myself, as I have no doubt that the plate mills either mill or grind the pattern on the rolls, whereas the model engineer must mill, or otherwise remove the metal between the raised portion. Anyhow, good luck to anyone who likes to try.—

" STEEL MERCHANT."



Full size drawing of chequer (2 in. by 1 in.) (Admiralty pattern)

QUERIES AND REPLIES

"THE M.E." FREE ADVICE SERVICE. Queries from readers on matters connected with model engineering are replied to by post as promptly as possible. If considered of general interest the query and reply may also be published on this page. The following rules must, however, be complied with:
(1) Queries must be of a practical nature on subjects within the scope of this journal.
(2) Only queries which admit of a reasonably brief reply can be dealt with.
(3) Queries should not be sent under the same cover as any other communication.
(4) Queries involving the buying, selling, or valuation of models or equipment, or hypothetical queries such as examination questions, cannot be answered.
(5) A stamped addressed envelope must accompany each query.
(6) Envelopes must be marked "Query" and be addressed to THE MODEL ENGINEER, 19-20, Noel Street, London, W.1.

Steam Plant for Model Tug

I am building a model steam tug, 3 ft. 6 in. long, and intend to power it with a Stuart Double 10 steam engine. Can you please advise me regarding the choice and design of a boiler and spirit lamp suitable for this engine. I note that in the issue of THE MODEL ENGINEER *dated July 8th, 1954, a blowlamp for a boiler is described. Can you please advise whether this is suitable for the above purpose, or any suitable combination of boiler and blowlamp?*

K.R. (Chelmsford).

We suggest that the "Trident Mark II" internal flue boiler, which was described in the issue of THE MODEL ENGINEER dated May 13th, 1954, would be suitable for your purpose.

The type of pressure vaporising blowlamp described in the July 8th issue would suit this boiler quite well. We do not recommend spirit firing for steaming a powerful engine such as the Stuart Double 10, as its heating efficiency is relatively low, compared with a petrol or paraffin blowlamp.

Adjusting Lathe Mandrel Bearings

Can you please advise me on the method of adjusting the headstock of my 4-in. "Eta" lathe, which has tapered bearings both at the front and rear, together with ball thrust-race? The difficulty appears to be in adjusting the front bearing in relation to the thrust-race at the rear, so that the latter is effective when taking a heavy side cut or drilling from the tailstock. There is a tendency for the mandrel to seize under these conditions. It would appear that the thrust pressure should be equally divided between the cone and the thrust-race, and radial load taken on the cone bearings alone.

W.J.M. (Shoreham-by-Sea).

We recommend that the following procedure should be adopted for adjusting this type of mandrel:

First, the bearing at the nose end of the mandrel should be definitely slackened off, by moving the bush towards the spur wheel. The rear bearing should then be adjusted by means of the screwed collar, until there is no perceptible end play. It may be found that the best way to do this is to tighten it up gradually until it is found to be somewhat stiff to work, and then slacken it back just sufficiently to enable it to run freely. The bush at the nose end is then adjusted by moving it towards the nose of the mandrel until play is similarly eliminated at this end.

Refrigerator Compressor

I have recently removed the compressor from a domestic refrigerator for repairs, and, having completed these, I should be glad of some advice on methods of recharging it.

(a) How is the gas introduced into the system?
(b) What kind of gas is used?
(c) Where and how can it be obtained?

J.H.S. (Stoke-on-Trent).

(*a*) In order to introduce the gas in the system, it is necessary to run the compressor as a vacuum pump and get rid of practically all the air in the entire system. This is done by shutting the valve between the evaporator and the compressor, and disconnecting the inlet union or opening the air-valve provided. It is also necessary to expel moisture by heating the system or using a chemical dehydrating agent.

(*b*) Domestic refrigerators use two or three different types of gases, including sulphur dioxide, methyl chloride, and Freon, according to their design, the essential difference being caused by the different pressures at which these gases are liquefied.

(*c*) We strongly advise that the services of an experienced refrigeration engineer should be obtained for charging up the unit, as a certain amount of specialised knowledge is required, and it would also be necessary to obtain his advice as to the gas for which the system is designed.

Adapting Lathe for Screwcutting

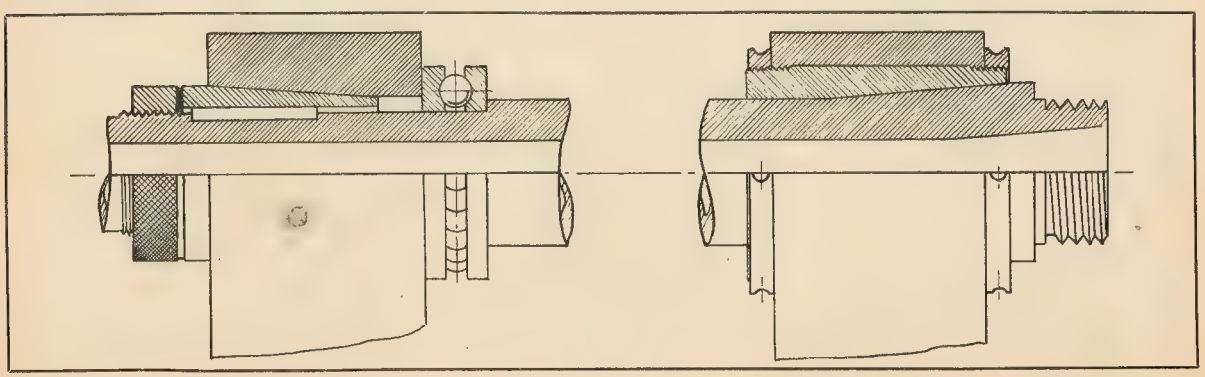
I have an old type 6 ft. heavy duty flat bed lathe equipped with traverse and leadscrew, but no change wheels, or a quadrant to carry them. At present I am using a vee-belt drive to operate the leadscrew to provide self-acting feed.

Can you please advise me:—
(a) of a suitable design for the bracket and studs for carrying the change wheels?
(b) the minimum number of change wheels suitable for general screwcutting?

C.R. (Southport).

(*a*) We regret in the absence of exact details of your lathe, that we are unable to furnish you with any drawings of the necessary fittings for carrying the change wheels, but numerous photographs of lathes from the headstock end which have been published in THE MODEL ENGINEER show these fittings very clearly, and it should not be very difficult to copy the change wheel quadrant, other fittings and adapt them to your purpose.

(*b*) With reference to the change wheels required for such a lathe, you omit to mention the most important detail, namely the pitch of the leadscrew, as this necessarily governs the number of wheels required, and also the number of teeth in each. Assuming that a leadscrew of 8 t.p.i. is used, a complete set of change wheels to cover most standard threads would consist of about 10 or 11 different sized wheels from 20 to 65 teeth.



READERS' LETTERS

FOR THE LOVE OF MIKE . . . !

DEAR SIR,—Your Christmas number is presumably intended to bring merriment and good cheer to your readers; but, instead, it has filled me with wrath and gloom. Wrath, because on the very first page you accuse me of filling up a hole with silver-solder—which amounts to a libel on my silver-soldering. The plain truth is, that I forgot to drill the——hole at all. Gloom, because of the gloomy forebodings from the article on the Electronic Organ. For the past three years it has been your practice to park anything which made loud noises, continuous or intermittent, alongside the Demonstration Stand at your Exhibition. If this is the prelude to the arrival this year of your contributors cat-propelled device, I must seriously warn you that the ensuing strike of demonstrators will be beyond the powers of any Ministry to settle.

However, nobody can say that I don't try to help, and if you can arrange to put it in some more suitable place —right alongside Messrs. Percival Marshall's stand, for example—I can supply, free of charge six of the cats required. All react satisfactorily to the impulse from the keyboard; and if your contributor can add a pedal which holds a small plate of dinner just out of their reach, he will obtain a loud and continuous note guaranteed to drown even the wailing of the S.M.E.E. for their lost railway.

Yours faithfully,
O.C. DEMONSTRATIONS.

THE DORSET BURRELL

DEAR SIR,—I thank you for publishing my letter in THE MODEL ENGINEER on November 18th, 1954, re The Dorset Burrell. I note that you have it as being sold to a Mr. Hurst, when it should read a Mr. Hunt.

Yours faithfully,
Dorchester. E. G. WHITE.

MODELS AT ST. ALBANS

DEAR SIR,—In THE MODEL ENGINEER published on November 18th, there was a photograph showing some exhibits of the St. Albans M.E.S. at the Mandeville School Fete. I would like to point out an error in that the model of the tug *Meg* was made and exhibited by myself. Mr. V. Vousden also had a model at the exhibition, but it could not be seen in the photograph.

Yours faithfully,
St. Albans. W. F. GROVES.

Letters of general interest on all subjects relating to model engineering are welcomed. A nom-de-plume may be used, but the name and address of the sender must accompany the letter. The Managing Editor does not accept responsibility for the views expressed by correspondents.

PHOTOGRAPHING MODELS

DEAR SIR,—In connection with the article which you published recently on the above subject, I offer a couple of hints which may possibly be of some use to such of your readers as may undertake this kind of work.

The first I picked up in the far distant days of my apprenticeship, and it concerns backgrounds. Instead of using a *fixed* white or neutral tinted background, hang behind the model to be photographed an old table-cloth, sheet, or perhaps best of all, piece of clean canvas or sacking, and during the exposure, keep it continually agitated, this results in an absolutely "dead" background, and completely eliminates the showing up of any creases, folds, or minor discolourations in the background sheet. We used this method in the works in which I served my apprenticeship for anything from a small bench machine to large mill and marine engines and pumps, and I have used it myself on many model photographs with complete success.

At the old works we had a labourer who always did the shaking job, and in consequence was known throughout the plant as "St. Vitus Charlie."

The other tip I picked up many years later during my association with the photographic industry is, during the actual exposure, to have a fairly powerful light bulb (the power will, of course, vary with the size of the model being photographed) mounted in a reflector, having a flexible lead, which is directed on the model and continually moved about in the hand.

The movement should be over a fairly wide area, and obviously the lamp must always be kept *behind* the line of the camera lens. This results in much improved diffused lighting and the complete elimination of harsh shadows and dark spots. A frosted bulb is preferable, and where there is a lot of highly polished work on the model, it may be well to use a muslin gauze or fine tissue paper screen over the lamp and reflector as well.

Yours faithfully,
Rustington. K. N. HARRIS.

AN UNUSUAL WINDMILL

DEAR SIR,—I have pleasure in sending you a photograph of the very unusual windmill that used to work at Haverhill, Suffolk.

With a tower nearly 80 ft. high, the mill is reputed to have been the only one of its type ever erected. Instead of the usual sails, it had eight radiating arms, which, before they were damaged, had a continuous band of vanes, each a foot wide and five feet long. The band was 50 ft. in diameter. The landing round the tower was at a height that enabled the miller to make adjustments to the vanes.

Yours faithfully,
Darlington. J. DENTON ROBINSON.

WHY NOT ALUMINIUM CYLINDERS ?

DEAR SIR,—In automobile manufacture, for some time it has been accepted practice to fit alloy pistons to cast-iron cylinders. Man, in spite of what some people would have us believe, is a conservative animal and does not take readily to changes, but I would like to bring to your notice, and that of model engineers, an idea

which might be well worth experimenting with, in view of the high price of copper and brass alloys today.

Some time ago, Mr. Cross of The Cross Manufacturing Co. of Combe Down, Bath, demonstrated before the Institution of Mechanical Engineers, Automobile Division, Western Branch, and also to the Bath Society of Model Engineers, a motor-cycle 250 c.c. engine having a sleeve valve of his own design and employing an aluminium alloy cylinder fitted with a steel piston with cross patent steel rings. This engine, which has shown remarkable results as to power and reliability, had done a great deal of running both on the test bed and on the road. Contrary to expectations, there was little or no cylinder wear; in fact less than with the normal combination of C.I. cylinder and alloy piston. There was no sign whatever of scoring, the cylinder wall having a finish like glass, with a slightly brownish tint.

In this connection, Mr. Cross pointed out that one of the accepted ideal combinations for a bearing was that of a hardened and ground shaft running in a white-metal bearing, the lubrication of course being satisfactory, and that a similar condition prevailed with a steel piston with steel rings working in an alloy cylinder.

It struck me, therefore, that if an alloy cylinder could stand up to the conditions prevailing in an air-cooled i.c. engine, why should they not also, provided lubrication was correct and piston and valves made of suitable steel (stainless for preference), be suitable for a small power locomotive? To the best of my knowledge, it has not been done, but there seems to be no reason why it should not.

What about it, you experimental model engineers?

With regard to the rings, I was privileged, together with the C.M.E. of the Pakistan Railways, to be shown round Mr. Cross's works and saw for myself how these rings are made. They are not turned from a pot ground and peened as is done with cast-iron rings, but are wound from a coil of special high-tensile flat section steel wire and are drawn through a large iron tube which has a series of gas jets along and inside both sides of it, thereby heating the wire to a red heat when it is wound off on to hardened and ground mandrels of various sizes according to the size of ring required, in a very similar way to that in which one winds a spring in the lathe, each coil being dead up against the next. The machine on which they are wound is automatically controlled by micro-switches and stops itself as soon as the mandrel is covered, or for any predetermined length of coil.

The final process is to slot the rings from the coil; this is done in a small machine fitted with a very thin carborundum wheel set at an angle, which is again micro-controlled, and slots the rings from the coil by making a diagonal cut across each ring. They are then, after gauging for size in the view room, ready for use, but as some commercial users are used to and require a polished ring, a number are lapped and polished to conform with their requirements. Mr. Cross informed us that this is quite unnecessary, however, as they work perfectly in the blue state in which they leave the mandrels.

It would appear that this type of ring is the answer to cylinder wear, an engine of a car to which they were fitted having run well over a hundred thousand miles without showing any signs of requiring a rebore. Mr. Cross was good enough to present me with two or three sample rings, and it is quite amusing to watch the faces of a garage foreman, or his mechanics, when one pulls and twists these rings, as it is practically impossible to break them, and they always spring back true.

In conclusion, I would add that I have no interest or connection with Mr. Cross's firm, other than that of an admirer of originality and a new and better way of doing things.

Yours faithfully,
W. L. FEDDEN, Lt.-Col.

[*Editorial Note: We know of at least one locomotive that has duralumin cylinders; it is Mr. E. W. Fraser's* Lorna Doone. *We believe that there are some readers who are making similar experiments, and we shall probably be hearing more about them in due course*].

TRACTION ENGINES

DEAR SIR,—I read with interest the letter from Mr. R. H. Clark in regard to the Aveling engine at Bishop Wilton, E. Yorks. I inspected this same engine several months ago. He is quite correct about the works number being 2107, but may I be allowed to correct him with regard to the date 1900, This engine would be at least 15 years old then. In my conversation with Mr. Ripley, it was obtained by him about that time, but it was not new by any means. Further to that, over the past 28 years I have driven about 50 different engines of various makes, about 20 of these have been Avelings, three of the earliest being No. 2888, No. 2919, No. 4800. The first two had the year of manufacture engraved on the number plate on the steamchest cover, these being respectively, 1888, and 1891; No. 4800 was new in 1901. Therefore, No. 2107 must have been new round about 1882 or 1883. The engine at Bishop Wilton has a wood front axle which also points to the fact that it is older than 1900. I myself have recently acquired Aveling No. 8030, which it is my intention to rebuild; this is a 4 h.p. compound, 5-ton steam tractor, built new June, 1913.

In conclusion, apart from engine driving and maintenance being my work, it is also my proud privilege to have been, over the past summer, the driver of what is without doubt the finest finished Fowler showman's engine in the country today, and which has been so much in your columns recently, Mr. W. D. Miller's Fowler *Excelsior* No. 14862. Thousands of people admired this engine when I had it under steam, generating, the whole three days on his stand at the Great Yorkshire Show at Harrogate in July.

Yours faithfully,
Liversedge. J. A. SMITH.

DEAR SIR,—I was interested to read the letter of Mr. Ronald H. Clark in a recent issue of THE MODEL ENGINEER on the subject of "an early Aveling engine." Whilst he is correct in the matter of mistaking a part number for the works number of the engine, may I venture to correct him in the matter of dating?

I also have "an early Aveling engine" which is still in good working order apart from a few leaking tubes, replacements of which are waiting to be fitted. In this case, however, the brass nameplate is still intact and bears both works number and date in unmistakable figures. These are: Works No. 2880, Date 1891. So the engine Mr. Clark refers to must be much older than 1900.

Incidentally, your readers may be interested to know that our good friend, Mr. J. N. Maskelyne, called on me several years ago, at my invitation, to see the engine in steam. We drove the old engine about a quarter-of-a-mile up the road, during which he told me it was his first experience of a footplate trip on a traction engine. The engine was highly honoured!

Yours faithfully,
Kingsclere. A. E. NEWBERY.

MAUDSLAY LATHES

DEAR SIR,—Your correspondent J.W. might find the following interesting: *English and American Tool Builders*, by J. W. Roe (McGraw-Hill 1916) and *A History of Mechanical Inventions*, by A. P. Usher (McGraw-Hill). The first is in Edward Pease Public Library, Darlington; and the second in West Ham Public Library. The Science Museum will probably supply photographs of the two significant lathes which Maudslay built (those built in 1797 and 1800 or thereabouts).

If any reader could supply me with information about a screwcutting lathe by Hindley, the York clock maker, I would be very grateful. I have references to a lathe built by him in about 1740. Although these are not conclusive, I believe that he, and not Maudslay, built the first (English) screwcutting lathe with leadscrew and changewheels.

Yours faithfully,
C. J. BROOKS,
Bletchley. D.L.C.Hons.

THE LOCOMOTIVE OF THE FUTURE

DEAR SIR,—It is with interest and a certain amount of amusement that I read the various opinions regarding this mythical steam locomotive of the future.

On reading certain writings within

these pages, one is apt to be convinced that the attainment of 180 m.p.h. by a steam locomotive, and, that a train once worked up to 100 m.p.h. can then be kept cruising at this speed on a reduced amount of effort from the locomotive, are performances which can be "easily" obtained.

I am not one for figures or graphs, but, if we have a train of 800 tons travelling at 90 m.p.h., there are certain definite resistances to forward motion, train drag or resistance, for want of a better term, and air resistance.

If we are going to have these suggested hypothetical high rail speeds then both streamlining of the locomotive and close coupling of the cars becomes necessary features of the complete train design in order to cut down the last item to a minimum.

We now double the speed from 90 m.p.h. to this "easily attained" 180 m.p.h., drawing 800 tons, the resistance to forward motion will now be at least four times as great as it was at 90 m.p.h., not twice as great as is usually assumed. The extra "power" or "effort" demanded from the locomotive, however, will be at least eight times as great as that required to produce 90 m.p.h. All this assumes 100 per cent. efficiency in every department, of course—how efficient is the steam locomotive ?

It took poor old *Mallard* nearly thirty miles of concentrated effort to work up to 126 m.p.h., then only drawing a featherweight load.

Let us quietly and soberly face the fact that the steam locomotive long since reached the limit of its development, particularly during this century. We have fitted it with every known device, except the kitchen sink, and the result of it all is that the locomotive which will "cruise continuously" at 100 m.p.h. has yet to be built.—The sad fact remains that the steam locomotive is the most inefficient producer of power in this world.

By all means let us build these "science fiction" locomotives in the popular small gauges but at the same time bearing in mind that the performance we obtain from them will in no way give an indication of what would obtain in full size practice.

This weekend will find me amongst some mighty four-cylinder Pacifics at Camden. I shall look at them with reverence and admire them as wonderful pieces of machinery, impressive, dignified, immensely powerful, but remembering that even when drawing only 400 tons it is only on rare occasions and as a result of supreme effort that they reach the magical 100 m.p.h.

How sad to think that their days are surely numbered.

One-hundred-and-eighty m.p.h. with a steam locomotive drawing 800 tons on 4 ft. 8 in. gauge—never; diesel or electric—probably.

Yours faithfully,

Kingsbury. D. A. SPROSON.

DEAR SIR,—I really must protest against Mr. Hockings' statements about his "Locomotive of the Future." It is obvious that no calculations have been made as to its performance and his figures are nothing more than wishful thinking.

First, I must correct the dimensions he has quoted for American boiler dimensions. Mr. Hockings had, in an earlier letter, accused me of over-estimating American boiler diameters. To "prove" this he quoted a number of examples. Now, all the examples he used were actually the minimum inside diameters of taper boilers. For some peculiar reason he has called these "maximum boiler diameters," although they are all about a foot too small for that. It is apparent that he has glanced through the picture pages of the American "Locomotive Cyclopedia" and seeing the words "boiler diameter," immediately jumped to the erroneous conclusion that it meant maximum boiler diameter. Had he taken the trouble to consult the boiler section of the book he would have found the correct figures.

Mr. Hockings also does not seem to see the importance of the boiler diameter in steam production. Well, the free gas area is proportional to the number and diameters of the tubes in the boiler, and this is quite naturally dependent on the size of the barrel.

Another thing which Mr. Hockings apparently does not understand is compounding. He proposes to run his machine with a short cut-off in the high-pressure cylinders in order to reduce the H.P. back pressure to a minimum; but he should know that the H.P. back pressure provides the driving force for the L.P. cylinders. With the steam in the H.P. cylinders expanded down to about 30-35 p.s.i. and a back pressure in the L.P. cylinders of, say, 15 p.s.i., the amount of work done by the L.P. cylinders would be negligible. To reduce the L.P. back pressure without affecting the steam production would need one of the modern exhaust arrangements—Kylchap, Lemaitre, or Geisl, for instance.

Now, for the performance of the thing. It is claimed that it will better the performance of some other fictitious engine which is able to haul 800 tons at 180 m.p.h. ! ! Using the Johansen formula for train resistance, this requires 27,000 d.b.h.p.

The only check of any sort that is available on really high speed running is that of the French 150 m.p.h. speed record. In this, 4,500 h.p. was required to keep a 109 ton engine and 105 ton train running at that speed. Hence, to maintain over 1,000 tons of steam engine and train running at 180 m.p.h. will obviously require something in the region of 30,000 i.h.p. This tallies remarkably well with the Johansen figure. Thus, Mr. Hockings will find himself about 25,000 h.p. short !

I will be pleased and interested to hear how he waves his magic wand to overcome these trifling difficulties. Perhaps he will invent some special coal or something with a calorific value of about 100,000 B.Th.U. per pound !

Yours faithfully,

Swindon. A. E. DURRANT.

ATMOSPHERIC GAS ENGINES

DEAR SIR,—I am very much interested in Mr. Proud's letter on his "Atmospheric Gas Engine," as I have a similar one in my possession. My engine still bears the label marked "System Loenier," and works on the same principle of flame ignition, firing the charge at half stroke, and exhausts on the return stroke. The air inlet and exhaust are cam-operated from a one-to-one cam shaft, driven by bevel gears from the crankshaft. The gas inlet remains open and is fed from a small gas bag. I should like to know if Mr. Proud's engine has the gas inlet controlled by the cam.

Yours faithfully,

Perth. A. HUTCHISON GALL.

Next Week . . .

IMPROVING THE LATHE
A reader's contribution to the never-ending quest for the elusive "ideal" machine tool.

METAL FINISHES
More information on the popular subject of polishing lacquering and blueing metal surfaces.

WATER-TUBE BOILERS
An ingenious adaptation of the Gurney type boiler by Mr. A. Goodall.

READERS' WORK
More photographs, with brief descriptions, of models already made or in progress, by "M.E." readers.

TROWBRIDGE EXHIBITION
The small, but enterprising society at Trowbridge, Wilts, recently organised an excellent and successful exhibition, as described and illustrated.

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THE MODEL ENGINEER

The asterisk (*) denotes that the subject is illustrated with photographs.

The dagger (†) denotes that the subject is illustrated with drawings.

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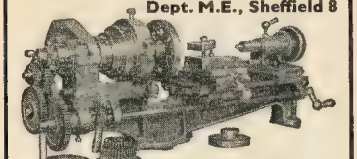

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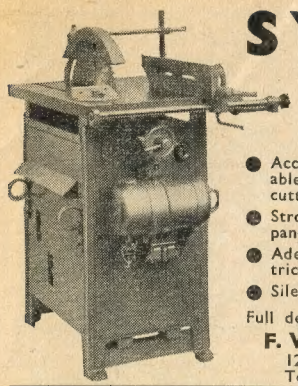

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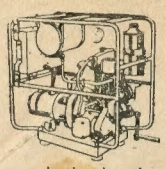

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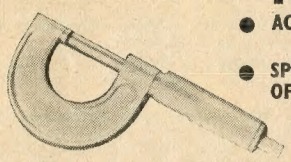

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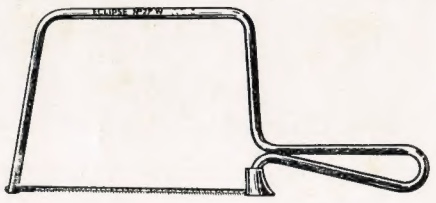

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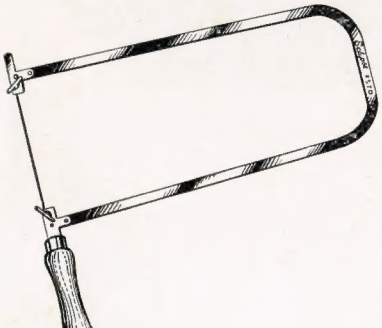

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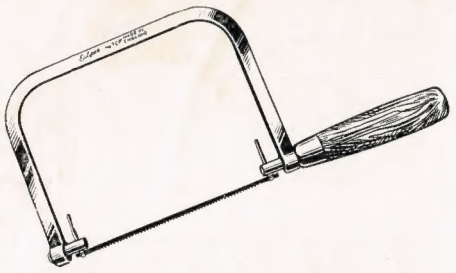

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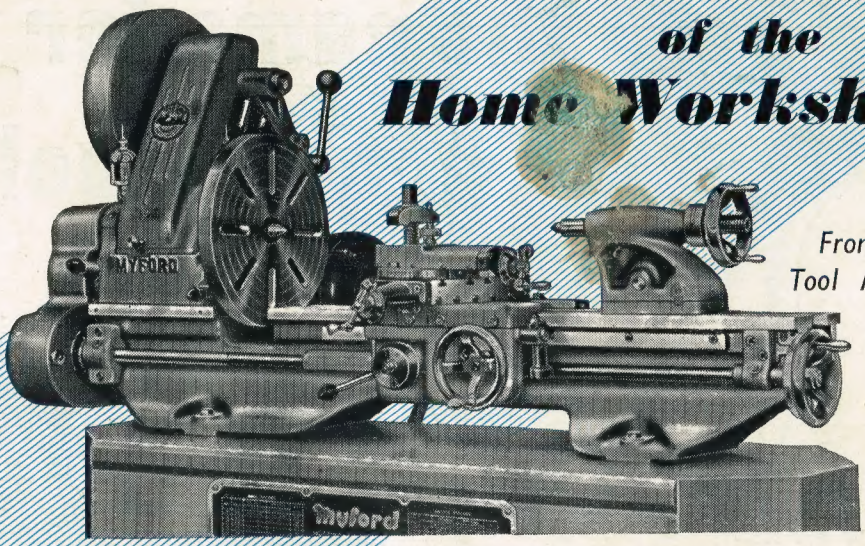

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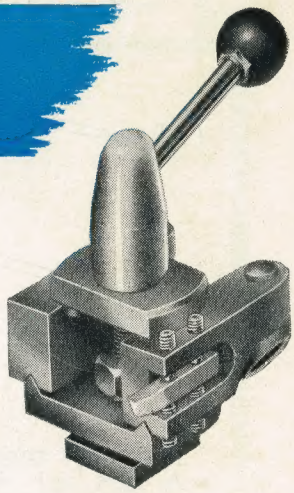

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